Report on the Administration
of the Department of Agriculture
United Provinces of Agra & Oudh.
1910-11 to 1920-21

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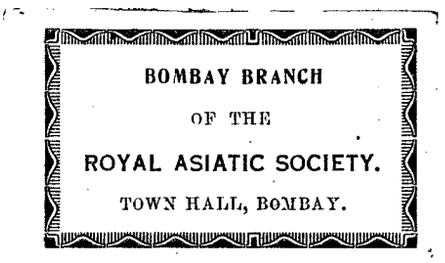

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REPORT

ON THE

Administration of the Department of Agriculture

OF THE

UNITED PROVINCES OF AGRA AND OUDH

FOR THE YEAR ENDING 30th JUNE 1911.

1910-11 to 26-17-1920

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REPORT

OF THE

Administration of the Department of Agriculture

OF THE

UNITED PROVINCES,

FOR THE YEAR ENDING THE 30TH JUNE 1911.

No. $\frac{1652}{\text{V—417A,}}$

FROM

W. H. MORELAND, ESQ., C.I.E., I.C.S.,

DIRECTOR, DEPARTMENT OF LAND RECORDS AND AGRICULTURE,

UNITED PROVINCES,

To

THE CHIEF SECRETARY TO GOVERNMENT,

UNITED PROVINCES, REVENUE DEPARTMENT.

Dated Lucknow, the 5th September 1911.

SIR,

I HAVE the honour to submit the report on the administration of the department of Agriculture for the year ending 30th June 1911. The scope of the report is unchanged, but the arrangement of the chapters has been recast to meet the recent suggestions of the Government of India.* It will be noticed that the subject of arboriculture which hitherto has been dealt with in chapter II, has now been relegated to an appendix: and that as a matter of convenience two chapters (IVA and IVB) cover the ground for which a single chapter was suggested.

CHAPTER I.

PREFATORY.

Officers of the staff.

I remained in charge of the department throughout the year. Mr. Burt, Deputy Director of Agriculture, held charge of the central circle during the year and also of the agricultural court at the United Provinces Exhibition. Dr. Parr, Deputy Director of Agriculture, resumed charge of the western circle on his return from privilege leave in September, and retained charge for the remainder of the year. Mr. Fremantle, Principal of the agricultural college, held charge of his post until April, when he proceeded on leave combined with vacation. Mr. H. E. Annett, who was appointed to officiate for him, took charge of his duties on the 28th June. Mr. Leake, Economic Botanist, held charge of his post until 20th April when he proceeded to England on privilege leave combined with a short period of deputation in connection with his investigations on the improvement of cotton. On return from leave on 5th November Mr. Clarke resumed charge of the post of Agricultural Chemist from Mr. Annett who had been officiating for him.

3. Mr. Bunting held charge of the post of Agricultural Engineer until October when he was transferred to the Public Works department; he was succeeded by Mr. Vick, who remained attached to the department until March when he was recalled to take charge of the Roorkee workshops. The post has been vacant since then as the Chief Engineer was unable to select an officer for the appointment; but he has kindly permitted Mr. Vick to assist the department with his advice in technical matters.

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* Vide G. G. O. No. 9-91-2, dated the 25th April 1911 in the Revenue and Agriculture department, and G. O. No. 1091/1—303, dated the 9th June 1911.

4. The Assistant Director, Mr. S. M. Hadi, Khan Bahadur, was on three months' privilege leave from 29th July 1910 and during his absence Saiyid Zamin Husain, temporary Assistant Director, held charge of the eastern circle. On return from leave Mr. Hadi held charge of his post till 4th January 1911 when he left the department after twenty years' continuous service on promotion to the rank of Deputy Commissioner. He was, however, placed on special duty for a short period in connection with the sugar demonstrations at the Exhibition. Saiyid Zamin Husain remained attached to the eastern circle as a temporary Assistant Director till Mr. Hadi's transfer from the department when he was appointed Assistant Director provisionally and placed in charge of the circle as a temporary measure. My Personal Assistant, Mir Saiyid Husain, held charge of his post till 10th May, when he went on two months' privilege leave and B. Shiva Prasad, Deputy Collector, officiated for him.

5. Towards the close of the year M. Akhtar Muhammad Khan, Deputy Collector, was placed on special duty in the department for the purpose of investigating the commercial prospects of sericulture in these provinces.

Tours of officers.

6. My rains tour in 1910 was practically confined to the inspection of the various departmental institutions. Part of October and November was occupied by the civilians' training class at Cawnpore, and on its completion I proceeded to Allahabad where I remained throughout the exhibition, except for occasional visits to Lucknow and Partabgarh. In March I accompanied the Inspector-General of Agriculture on a portion of his tour in the province, visiting in his company Lucknow, Kathgodam, Douglasdale, Cawnpore and Orai, and in April I visited Shahjahanpur in connection with sericulture and Bareilly on matters connected with the sugar industry.

7. But for short visits to the agricultural stations in the circle, the Deputy Director of Agriculture in charge of the central circle remained at Allahabad almost continuously until the close of the Exhibition. In March he visited the Bombay presidency in connection with the cultivation of groundnuts, and the Central Provinces in connection with wheat-growing. Later in the year he visited the Mainpuri and Unao districts to meet agricultural associations, and also met the Imperial Agricultural Chemist at Pusa in connection with the investigations into alkali lands. The Deputy Director of Agriculture in charge of the western circle toured within his jurisdiction between October and April, mainly with the object of superintending the demonstrations in progress. During March he visited two agricultural stations in the Punjab. The tours of the Assistant Directors in the eastern circle were concerned mainly with the organisation of sugar-factories: much of their time during the winter was spent at Allahabad in connection with the demonstrations at the Exhibition.

8. The Principal of the agricultural college and the Economic Botanist made no tours during the year, but both officers spent some time at Allahabad in connection with the agricultural conference. The Agricultural Chemist, who also attended the Conference, as usual spent part of the cold weather at Partabgarh in connection with the sugarcane experiments in progress. The Agricultural Engineer visited several districts in order to advise landholders on schemes for establishing pumping installations.

Special features of the year's work.

9. Undoubtedly the most prominent feature of the year's work has been the agricultural court at the United Provinces Exhibition. Some particulars of this organisation are given in a later chapter: here it is sufficient to say that so far as can be judged it came at just the right time, and that it has been most effective both in creating fresh interest among the public, and in focussing and directing the vague and general interest which had sprung up during the last few years. Its full effects will not be immediately apparent, but already there can be no doubt that it marks the commencement of a new epoch in the agricultural development of the province. The public interest in the court was maintained throughout the period during which the Exhibition remained open, but an attempt was made, and successfully, to concentrate the attention of landholders during the week devoted to the Agricultural Conference. This conference was certainly unique in the annals of the province as a gathering of practical men interested in the improvement of

agriculture, and its value was greatly enhanced by the attendance of a large number of officers of the Imperial and Provincial departments of agriculture, who placed their knowledge and experience so readily at the disposal of the audience.

10. As regards the equipment of the department, the permanent buildings of the college and research laboratories were brought into use during the year, and the only important project outstanding in connection with the central institution is the provision of a library building. It has been decided to build a science library for the joint use of the departments of agriculture and industries, and it is hoped that construction will begin during the current year. In this connection it may be noted that a site adjoining the college and laboratories has been provisionally selected for the technological institute, so that there will be no obstacle so far as space is concerned to the close co-operation of the two departments which is so desirable in the interests of progress.

11. The completion of the central institution marks a definite stage in the development of the department; the next step must be to organise the required number of agricultural stations. The funds available for this purpose were last year allocated to the proposed seed-farm at Aligarh: a site was selected, but the objections raised to it by the local authorities were held to be valid, and a year was thus lost since it would be most unsafe to select land on which cotton is to be grown without careful observation during the rains. It is hoped that a site will be selected and the farm brought into existence during the current year. The next step must be the provision of an agricultural station in the sugar-yielding tract of Rohilkhand, and after this the eastern submontane tract will claim the first consideration. It must however be recognised that the provision of nine or ten stations as originally proposed will no longer satisfy the public: there is a growing demand, which was voiced with authority at the agricultural conference, for a minimum equipment of a station in every district,—not necessarily an experiment station, but a local centre from which demonstrations shall radiate and where the public can apply for advice or assistance in case of need. The demand is perfectly legitimate, but I do not consider that the whole charge of such stations should be met from provincial funds, and I hope shortly to work out the main lines of a scheme under which subordinate stations can be established by the department in co-operation with local public bodies or associations.

12. As regards staff, proposals have been submitted for employing a second Economic Botanist, to meet the growing demands of this branch of the department's activity; and a decision has been arrived at as to the terms to be offered to Assistant Directors, one of whom will be posted to each circle to assist (and if found qualified eventually to succeed) the officer in charge.

13. The appointment of a Director of the newly-created department of Industries may fitly be mentioned here because hitherto, in the absence of such an officer, it has fallen to the lot of the agricultural department to meet as far as possible requests for assistance and advice in industrial matters. The Industries Department now deals with such matters, and has taken over the control of the weaving schools, which have been referred to in previous reports, and certain portions of the statistical work hitherto placed in my charge: but it has been decided that questions affecting the sugar industry shall for the present remain in my hands, and that the officer appointed to test the possibilities of sericulture shall be under my control, the common ground for these decisions being the intimate connection of these industries with the system of agriculture.

CHAPTER II.

Agricultural Education.

The Agricultural College.

14. The course of studies at the agricultural college remained substantially unaltered during the year. At the final examination 34 students obtained the degree of L. Ag. The examination was conducted by officers of the department with the assistance of two outside examiners, for whose services the college is indebted respectively to the Government of the Punjab and to the Educational department of these provinces.

15. Two students have been admitted from natives states: the remainder are domiciled in the province. I must again record that the leading landholders'

associations failed as a whole to respond to the offer of preferential admission for their nominees ; one student however was admitted on the nomination of the Muzaffarnagar zamindars' association. The applications for admission now being received are more promising, and indicate that it will be possible this year to admit a larger number of students connected with the land than before : the conjecture may be hazarded that the discussions at the Agricultural Conference have contributed materially to this result.

16. The permanent buildings are now occupied, and it may be hoped that the greatly increased facilities for instruction which they offer will result in more fully trained students. A beginning was made during the year in the organisation of the agricultural museum, for which, in the absence of accommodation, few acquisitions have hitherto been made : several most interesting exhibits were purchased at the close of the exhibition.

17. The constitution of the Governing Body was unchanged during the year. The members devoted much time to formulating proposals for revising the course of studies at the college and establishing classes for the training of small landholders and rent-collectors. Their proposals, which I regret I found myself unable to support, are now before Government.

Other agricultural training.

18. No information has reached me regarding the agricultural school started by the Hon'ble Thakur Kushalpal Singh. During the debates in Council questions have been raised during the year regarding (*a*) instruction in agriculture in secondary schools and (*b*) attaching model farms to such schools. These questions concern primarily the Educational department, whose duty it is to formulate the course of studies for such schools ; and I have not received from the Director of Public Instruction any request for assistance in this direction. My own belief is that such action would be a mistake, at any rate in the present stage of educational development and I think the opinion is steadily gaining ground that the secondary school is not the place for specialised technical instruction : but the Department will co-operate as far as possible in any schemes that may be approved by the educational authorities.

19. The analogous question of agricultural teaching in rural primary schools has been the subject of considerable discussion in the Rural Education Committee on which I have served during the past year, and it has been decided that direct agricultural teaching would be out of place, and that the course should not go beyond object-lessons and nature-study, which in rural schools would naturally deal largely with the features of the local agriculture.

20. The Committee decided at my instance that an attempt should be made to introduce one series of object-lessons dealing with insect-life. The *eri* silk-worm has been chosen as the most suitable for this purpose, and I have drawn up a scheme of object-lessons on its life-history, which has been accepted by the Director of Public Instruction, and will be introduced experimentally this year in some schools in Shahjahanpur, where M. Akhtar Muhammad Khan, the sericulture officer, will be able to assist the teachers.

Sugar schools.

21. A training-centre for instruction in sugar-making was organised at Partabgarh during the year, and the students were subsequently transferred to the demonstrations at the Exhibition. Fifty-six students received complete training, and in addition a number of professional boilers were trained in special branches. All of the latter, and a proportion of the former, found employment in factories during the season.

Horticultural education.

22. No important changes have been made in the tentative courses of training in horticulture organised at Lucknow and Saharanpur. Of the two overseer students admitted in 1908, one failed to qualify, but the other is now in charge (on probation) of the Fyzabad public gardens. The qualification for the admission of European students to this class is being raised with effect from the present year to the high school standard. The classes for heads gardeners *(chaudhris)* are doing really good work, and the students have no difficulty in getting remunerative employment.

Weaving schools.

23. Nothing need be said here regarding the weaving schools, which are now under the control of the Director of Industries.

CHAPTER III.

Research and Experiment.

24. Of the sub-divisions suggested by the Government of India for this chapter, there is nothing to report under entomology, mycology or pisciculture. The study of the fisheries of the province has not been taken up, while we depend on the officers of the Imperial department for entomological and mycological research, the functions of the provincial department being to put the results of research into practice. The remaining sub-divisions are dealt with in the following paragraphs.

Agriculture.

25. Experimental farms are attached to the agricultural stations at Cawnpore, Orai, Aligarh, Partabgarh, Benares and Atarra, but the two last named are not yet sufficiently organised to carry out important researches. At Cawnpore the majority of the investigations are of a fundamental nature, and undergo little change from year to year. Among newer experiments are the study of the manurial value of sugar-refuse, calcium cyanimide and nitrate of lime : the study of the effect of stubble-ploughing as contrasted with unbroken fallow; and the comparison of different methods of cotton-sowing. The comparison of different varieties of wheat, arhar, groundnut and cotton has continued. The more permanent experiments in progress include the continuous growth of crops on the same land under various manurial treatment, the study of various rotations, and the determination of the water requirements of the more important crops and of losses of water by seepage and evaporation. The study of soil-moisture relations, carried out in conjunction with the Imperial Agricultural Chemist, has also continued.

26. The investigations in progress at Orai deal with the question of tillage in Bundelkhand soils, both generally and in relation to *kans*; the utilisation of some of the inferior soils; and the possibility of introducing improved varieties and greater diversity of cropping in the locality.

27. The experimental work in progress at Aligarh falls under two main heads; (a) the test of varieties of crops (including at present wheat, sugarcane, cotton, maize and groundnuts); and (b) investigation into methods of cultivation of wheat, maize, cotton, juar and groundnuts.

28. The work at Partabgarh is at present mainly concerned with the cultivation of sugarcane. Certain experiments on this crop have been directed by the Agricultural Chemist, and these have now reached a stage where the results can be discussed; a bulletin on them is under preparation. A systematic trial of the leading local varieties of cane considered as sugar-yielders has now been undertaken. The remaining investigations carried on at this station comprise the test of new crops and varieties, the chief staples under experiment being rice, maize, hemp and jute; the reclamation of ravine-land; and the use of gypsum for the cultivation of alkaline soils.

Chemistry.

29. The principal investigations of the Agricultural Chemist are those to which reference has just been made in connection with sugarcane. The investigation of the glucoside obtained from *Tephrosia* has been completed and published in the *Transactions* of the Chemical Society. A short investigation of the composition of the juice of the agave is in progress, and the Agricultural Chemist is now taking up the chemical side of the question of the effect of environment on the baking qualities of wheat, this investigation being conducted in collaboration with Mr. Howard and Mr. Leake.

Botany.

30. Owing to the absence of the Economic Botanist in England, I am unable to give a full account of the botanical investigations in progress. They relate principally to the production of better cottons, the examination of the wheats of the province, and (in collaboration with the Imperial Economic Botanist) an investigation of the influence of the environment on the milling and baking qualities of wheat.

Sericulture.

31. The study of silkworms carried out at the Pusa Research Institute has indicated that conditions in the United Provinces are favourable to the *eri*-worm, and that the mulberry-worm also is worth a trial. M. Akhtar Muhammad Khan, Deputy Collector, has

now been placed on special duty to collect data from which the commercial prospects of the industry can be judged. As he assumed charge of his duties only at the close of the year, there is as yet no progress to report on this investigation.

Engineering.

32. The report on percolation-wells prepared by Mr. Bunting was considered during the year in consultation with the Chief Engineer of the Irrigation department. The design prepared by Mr. Bunting was found to be too large and costly for the ordinary landholder, and its introduction was considered to be within the scope of the Irrigation department. The Agricultural Engineer was asked to adapt the design if possible to wells such as the ordinary landholder can construct, but the changes in the post during the year have prevented further progress in this direction. For the same reason no progress has been made in the study of the conditions under which power-pumping from spring wells can be recommended. It is much to be desired that the post of agricultural engineer may be put on a more satisfactory basis in order that these, and other questions may be worked out without further delay.

Economics.

33. The pressure of work connected with the Exhibition has prevented much progress being made with economic investigations. The preliminary work of the cattle-survey has however been completed, and a large mass of data accumulated, the discussion of which will necessarily take some time.

CHAPTER IVA.

Assistance to the Public.

Distribution of implements.

34. The year has seen a considerable development in the interest taken by the public in labour-saving implements, and also in the facilities for their supply, both developments being largely the result of the display of implements at the Exhibition. No complete record is available of the orders booked while the Exhibition was open, as enquiries were usually referred to the stalls at which purchases could be made, so that the figures for sales by the department are not comparable with those of previous years when it was the only agency available to the people.

35. The implements sold by the department during the year comprised ploughs (550), chain-pumps (70), maize-shellers (74), chaff-cutters (28) and kibblers (22), as well as various other implements in smaller numbers. The great majority of the ploughs sold were again of the Meston type, the balance being mainly Watts, but in the western circle the larger cultivators are beginning to enquire for something heavier than the Watts' type, such as the Turnwrest or the Raja, both of which are now procurable in the provinces. Ploughs of the Meston and Watts types are now made in Calcutta, and also by Messrs Ransome, Sims and Jeffries in England, so that it has been possible to discontinue their manufacture in the departmental workshops. Chain-pumps also are now obtained from Indian manufacturers.

36. Proposals have been approved during the year for the maintenance of a list of recognized dealers in implements having establishments in the United Provinces, the custom of the department being given to dealers on this list in preference to others. It is hoped in this way to encourage the maintenance of stocks at convenient centres in the province, and thus open the way for direct dealings between sellers and users. The first firm to be placed on the list was that of Messrs. Burn & Co., of Howrah, who have recently opened a branch establishment in Cawnpore.

37. The system of sub-centres for the popularization and sale of implements has been maintained. It has not been uniformly successful, depending as it does so largely on the sustained interest of the person or persons who undertake to manage a depot: thus the depot on the Chandapur estate in Rae Bareli has been closed as useless, and that maintained by the Hon'ble Thakur Khushalpal Singh has reported no sales during the year. On the other hand depots in Mainpuri, in Unao and elsewhere have done much useful work, and the experience gained so far points to the conclusion that the most hopeful arrangement is management by a genuine agricultural association or by a co-operative society.

It must be added that during the past year the operations of the depots, like other agricultural work, have in some cases been greatly hampered by the prevalence of plague.

Sugar machinery.

38. A few words may be said as to the supply of sugar-machinery to the public. An examination of the accounts of the imprest provided for this purpose shows that in the last three years pans and machinery worth in all Rs. 1,17,000 have been purchased by the public, apart from the stock which is kept for hiring purposes. Among the machines issued are included 31 centrifugals of which 14 are power-driven: but manufacturers are now selling centrifugals to users without the intervention of the department, so that this number does not indicate all that are at work. The imprest has thus served its function of facilitating a start, and it may be hoped that the intervention of the department in the supply of standard machines will soon become unnecessary.

Distribution of seed.

39. The chief features of the year's demand for seed have been a reduced number of large indents, an increased demand for small quantities for trial, and a keen demand for groundnuts. The largest indent dealt with was for 600 maunds of Muzaffarnagar wheat for Egypt, which was supplied through the Sisauli seed-farm, a private enterprise worked by a diplomate of the agricultural school which has been of material assistance to the department from time to time. Nearly 150 maunds of groundnut seed have been issued for the current year: the popularity of this crop wherever it is demonstrated is very striking, and there is now every reason to think that it will become established as an additional resource of the province.

40. Among other features of the demand for seed the following may be mentioned. A variety of *arhar* (*Cajanus indicus*) which ripens about November was found growing in the Unao district. It has been tried at Cawnpore and found to be suitable for certain combinations of crops, and a demand for it is now arising in various places, notably in Hamirpur for sowing with cotton. Experiments at Aligarh have shown that the white-flowered variety of the local cotton is more remunerative than the commoner yellow-flowered type, giving an increased yield of cotton and a much higher proportion (about 40 per cent.) of fibre to seed. Sixty-eight maunds of the seed of this cotton have this year been distributed from Aligarh, and arrangements are in progress for securing a larger stock to meet the increasing demand. At Aligarh too a keen local demand has arisen for some of the varieties of sugarcane which did well at the experiment station, and 400 maunds of seed canes have been issued. Similarly there is a ready market in the eastern circle for the best canes produced at Partabgarh. The popularity or Muzaffarnagar wheat shows no signs of diminution: landholders who have obtained it from the department now usually save seed for themselves and supply it to their cultivators.

Seed-wheat for Jhansi.

41. Special steps were taken during the year to supply seed-wheat to parts of the Jhansi district where as is well known the area under this crop is much less than was formerly the case. About 1,200 maunds of *kathia* wheat, purchased in the Jalaun district, were distributed last autumn either on cash payment or against *takavi* vouchers, and the result has been so satisfactory that further supplies of *kathia* wheat and a stock of good *pissi* wheat have been provided for issue in the current year. Both these varieties are well known in Bundelkhand, and neither is by any means perfect; but it is hoped that the supply of the most suitable wheat available at the moment will bring the department into friendly relations with growers, and thus facilitate the introduction of still better varieties when these become available as the result of experiments in progress at Orai.

Seed depots.

42. The seed depots in the eastern circle were worked on the same lines as in previous years, and on about the same scale, the total issues being close on 13,000 maunds. A noticeable feature of the year was the extent to which cultivators saved their own wheat seed from the good crop of 1910; this indicates a distinct advance in the economic position, but it is too early to say whether it is temporary or will be maintained. The wheat crop of 1911 was undoubtedly inferior in quality in South Oudh,

and a large proportion of the seed recovered has been set aside to be sold off as unfit for issue, while fresh seed has been imported from Muzaffarnagar to maintain the quality of the stock. The financial position of the depots continues to be satisfactory, and the accumulated profit is sufficient to enable expenditure to be incurred freely on fresh importations. During the current year operations will be extended to the Benares district where the existing seed-stocks are certainly inferior in many cases.

43. The foregoing paragraphs will indicate the advance made towards carrying out the policy accepted by the department under which the agricultural stations are centres for supplying seed of new crops and varieties, and of better quality than is otherwise within the reach of the cultivator. The suggestion made in the debates in Council that this is the function of experimental farms betrays some confusion of thought: an experimental farm is for experiment and nothing else; the supply of seed the suitability of which is established is part of the 'assistance' branch of the department, and like other branches is being developed as staff and resources permit.

Well sinking.

44. The character of recent seasons has, as was to be expected, reduced the activity of the people in sinking new wells, and I understand that the capital available has been in excess of the demand for advances. With fewer wells under construction there has also been some diminution in the demand for assistance from the department, so that it has been unnecessary to increase the staff and equipment as had been contemplated. The staff has however been as fully employed as circumstances have permitted: the increased number of wet days during the year has involved more idleness than usual from this cause, while in many districts the presence of plague has brought work to a standstill for weeks at a time. On the other hand the improved management of the departmental workshop, and the extended use of local facilities for repairs, have considerably diminished the duration of interruptions to work caused by the want of tools, and in several districts the management of the borers' programmes has shown distinct improvement. Interruptions from defective programmes are still however more numerous than they should be.

45. In trial borings the percentage of success (65) is distinctly lower than in the previous year: the great majority of these trials are made in the western districts, where the foundation-clay is most irregularly distributed, and in Rohilkhand as large a proportion as four sites in ten have proved unsuitable. As usual most of the year's work has consisted in attempts to increase the supply in existing wells, and here success has been obtained in 69 per cent. (as against 67 per cent. in the previous year). The largest number of wells have been bored in Mainpuri, Benares and Rae Bareli with percentages of success between 80 and 85.

46. The average speed of boring, which goes far to determine the cost to the landholder, has not improved as I had hoped being somewhat under 22 feet daily as against nearly 24 feet last year. The falling off is attributable in part to insufficient labour-supply, as some landholders are apt to provide less than the full number of coolies required; and in part to the fact that the work has lain on the whole in rather more difficult country.

47. Mention was made in last year's report of the success that had been attained in improving the water supply in parts of the Banda district. The value of this work has been confirmed by the Deputy Director's personal experience during his tours in the district. During the year I have allowed my well engineer to advise the local authorities regarding the wells in Najibabad town where the water supply is very deficient at certain seasons. The well engineer has also begun an enquiry into the permanence of the improvement effected by boring: so far as the enquiry has gone it has shown that unlined boreholes are apt to choke very quickly, but that if a borehole is lined with piping it has the prospect of a long life. This confirms the practice of the department in advising owners to have the bores lined in all cases.

Poultry.

48. The poultry farm at Haldwani has been maintained during the year for the supply of good "utility" birds for breeding, and a considerable extension of the stock is contemplated for the coming season.

Sheep breeding.

49. Arrangements have been entered into with the proprietor of the Ghagar farm in Kumaun for a supply of cross-bred rams to be distributed in the Himalayan districts with the object of improving the yield and quality of the wool. It was hoped that the first distribution would be made last spring, but an outbreak of disease rendered a postponement necessary.

Sericulture.

50. As has been mentioned in the preceding chapter an officer has been placed on duty to determine the commercial possibilities of sericulture in the province. His services are also at the disposal of the public for the supply of seed and appliances and as adviser to persons who are taking up the matter. The number of enquiries received since his appointment shows that considerable interest has been aroused among the public.

Combating insect pests.

51. The cane grasshopper (*Hieroglyphus furcifer*) was somewhat less noticeable during the year than has recently been the case, but its existence was reported in most districts on the eastern side of the province. Experience has shown the value of the measures recommended by the department on the advice of the Imperial Entomologist, and orders were issued during the year to Commissioners and District Officers in the affected areas to impress on the larger landholders the necessity of taking action over a large area. Illustrated pamphlets dealing with the subject were also distributed widely by the department. The effect of these measures cannot be known until the coming autumn.

52. During 1910 it became apparent that the potato-moth, which has long been known in adjoining provinces, had established itself in Lucknow, having probably been introduced with seed potatoes brought from Patna. Methods of storing potatoes designed to check this pest have been demonstrated by the department in Lucknow, and also in Cawnpore and Farrukhabad where it has not yet appeared in numbers. Pamphlets dealing with this pest have also been distributed, and it is hoped that early information will be given to the department of its appearance in any other centre. Potato-growers should however make it an absolute rule not to import seed potatoes from any place which is not known to be free from the pest, since its distribution ordinarily takes place through seed potatoes: the use of seed potatoes from Kumaun is recommended for the present.

53. As regards other insect pests, it may be noticed that the rice bug which periodically injures rice (especially the finer and later varieties) during the flowering stage has been found to depend for its continued existence largely on the wild rice and grasses growing near rice-fields: clean cultivation is therefore being recommended as an effective method of keeping this pest in check. The borer *Chilo simplex* has recently been causing considerable injury to juar as well as to sugarcane: a pamphlet describing simple preventive methods is in preparation.

Miscellaneous.

54. The foregoing paragraphs indicate the chief directions in which assistance has been furnished to the public. In addition to them, assistance has been provided for individual enquirers in a variety of cases too numerous to be specified: there is a growing appreciation of the department's capacity, and requests for assistance are received in somewhat embarrassing variety, but are met so far as is possible.

CHAPTER IVB.

Associations, shows and demonstrations.

Agricultural associations.

55. During the Agricultural Conference the opinion was expressed by many speakers that the formation of agricultural associations was one of the greatest needs of the province, but much misconception is still prevalent as to the conditions required for their successful working. The tendency still is to form associations without a sufficient proportion of working members or in the alternative without a paid executive, and the inevitable result is a certain amount of talk and writing but very little practical benefit either to the members or to their tenants. The conception of an association as a body of working members must become familiar to the public

before much progress can be expected in this direction. At the same time there are signs in the particulars given below that a few genuine associations are coming into existence, and doubtless their practical success will lead to an increase in the number.

56. In the central circle, the Porter Association (Allahabad) held no meetings during the year, but its members rendered considerable assistance in connection with the Exhibition. The Mainpuri Association has been active, and about 40 of its members are taking part in practical demonstrations of new crops or varieties, the use of iron ploughs, and improved methods of maize-cultivation. This association has also interested itself in the capture of the destructive wild cattle in its vicinity, and has distributed the animals captured among its members. The Gauria Kalan Co-operative Bank in Unao continues its interest in agricultural improvement: it maintains a useful sub-centre for implements, owns a set of boring tools for its members' use, and has bought a large quantity of groundnut seed in order to introduce the crop; it also held an agricultural show and a cattle-fair at which a brisk business was done. Three small associations have recently been formed in the Safipur tahsil of this district, composed mainly of members of three local co-operative societies; they are practically off-shoots from the Gauria Kalan bank, and their activities will be watched with interest.

57. No particulars have reached me regarding the activities of the associations in the western circle, to which reference was made in last year's report. A new association has been formed at Baraut in the Meerut district, but in this case too, no detailed information has reached me. In the eastern circle, an association has been formed at Walipur in the Sultanpur district. It has made a promising start, but it is too soon to pronounce an opinion as to its ultimate utility.

The Exhibition.

58. Among agricultural shows, the agricultural court of the United Provinces Exhibition naturally claims the first mention. It was organized by Mr. Burt, the Deputy Director in charge of the central circle, and absorbed most of the time of his staff throughout the year besides making considerable demands on the staff in all other sections of the department, and drawing on the revenue services for a number of tahsildars and kanungos. The main object of the organization was to familiarize landholders with labour-saving implements and machinery, and the cordial co-operation of European manufacturers and Indian agents enabled Mr. Burt to bring together a collection of implements and machines that was probably unique for quantity and variety, and certainly unique in the degree of adaptation to local requirements. A full account of the agricultural court has been contributed to the final report of the Exhibition Committee, and it will be sufficient here to indicate a few of the salient features.

59. By common consent the most interesting display was the collection of waterlifts of most known types that surrounded the lake and gave working demonstrations at short intervals. There can be no doubt that this collection, together with the various small engines in the neighbourhood, enabled large numbers of Indian visitors to realise for the first time the practical utility of small power-producers, and especially of oil-engines, both for pumping and for other forms of work. During the exhibition I heard not a few sage comparisons drawn between the oil-engines and the bullocks working close at hand; and the number of serious enquiries for power-plants that have been received during the exhibition and since its close leaves no doubt that the new idea has taken hold of the imagination of the people.

60. The sugar factories probably came next to the waterlifts as an attractive and educative display; and here too it may fairly be claimed that a new idea has been established in the widespread recognition of the fact that white sugar can be made by modern machinery without using substances obnoxious to the orthodox Hindu. The prejudice against machine-made sugar has to be broken down before the sugar industry of the province can be placed on a satisfactory basis; and the sight of sugar being produced daily in a factory open from top to bottom to every visitor has done more than could have been accomplished by any amount of writing and speaking. The utility of this exhibit was largely increased by the

courtesy of Mr. Hulme, the engineer in charge of the factory: not every manager would have kept the factory going with every inch of space crowded by sight-seers, and stoppages were made only when the over-crowding was such as actually to endanger the safety of the spectators.

61. The working dairies again, exhibited by Mr. Keventer in conjunction with the Dairy Supply Association, were both attractive and useful. The cowshed was the most popular section with many visitors from the country, who while saluting each sacred animal in turn, appraised its quality with experienced eye: but the middle classes were intensely interested in the processes of handling the milk and making butter; and I understand that as a direct result of these exhibits dairies conducted by Indians have already been established at Benares and Lucknow. In the same way the silk-house has set large numbers of people thinking about the introduction of this new industry: several commercial men have learned for the first time the variety and quality of the produce available in the province: and speaking generally I think the claim may fairly be made that a substantial and permanent educative advance has been secured.

62. The criticism was occasionally heard that visitors of the cultivating classes showed the least interest in what should have interested them most. This is true on the surface: the cultivator gets few holidays, and this (as one of them told me) was *the* holiday of his life: and the variety of interesting things in the exhibition was perhaps too great to be appreciated fully in a single visit. But the fact remains that very large numbers of cultivators have seen enough to widen their whole out-look, and are thus prepared to understand demonstrations when these reach their villages; they have new subjects of conversation that will last for a long time in the slow life of the country-side; and very large numbers have carried home with them illustrated leaflets and price-lists which will form no mean addition to the stock of village-literature.

63. To assign the credit for the success of the agricultural court would be an invidious task. All classes concerned worked their hardest, the representatives of exhibitors, the managing and demonstrating staff, and even the menial establishment, while no frequent visitor could fail to notice the high standard of conduct maintained by the police on duty and their anxiety to assist spectators in all difficulties. But I cannot leave the subject without placing on record my appreciation of the work done by Mr. Burt in the organisation and management of the court: his versatility, his sustained energy, and his readiness in emergencies alone made the organisation possible, while the same qualities were conspicuous in the management throughout the period during which the exhibition was open.

Agricultural shows.

64. The usual shows were held in the western circle, and as usual the holiday element predominated in them. In the eastern circle the Sultanpur show was abandoned owing to the prevalence of plague, but a new show was organised in Rae Bareli, and another was held at Debi Patan in Gonda. In the central circle shows were held in Mainpuri by the association, and in Unao by the Gauria Kalan co-operative bank. A district show was held at Hardoi, and a small show at Sangwan in the Cawnpore district.

65. The question of encouraging agricultural shows has been raised during the debates in Council, and I am at present discussing, in consultation with the Director of Industries, the most suitable classes for which prizes can be offered at such shows. But the conclusion I have formed from the experience of the last twelve years is that shows organised from outside are not likely to be of much permanent use: the true line of development lies in their organisation by genuine agricultural associations. Obviously the associations must come first and the shows must follow, but the examples of Mainpuri and Unao indicate that the interval will not be great.

Cattle shows.

66. The two cattle shows held during the year in the Banda district were poorly attended, and neither can be described as a success. An informal show was held at Aurangabad in the Kheri district, largely with the object of getting cattle for the Kheri bull-depot, and it was successful from this point of view. The remarks made above regarding agricultural shows apply with even greater force to cattle shows.

Poultry shows.

67. Local poultry shows were held during the year at Naini Tal and Lucknow, and were successful, while an All-India show was organised at Allahabad in connection with the Exhibition. This show was well supported by fanciers from all parts of India and the birds exhibited were of very high class : at its close a meeting was held to found an All-India Poultry Club, which has since been definitely constituted. Apart from the show, the model poultry-farm with its modern appliances and pedigree birds was an attractive feature of the Exhibition, and resulted in the introduction of some really good stock into the country.

Private farms.

68. A few landholders maintain farms which serve in a varying degree as centres for demonstration. In the central circle Rai Ragho Prasad Narain Singh Bahadur devotes special attention to sugarcane on his farm at Baraon, and this farm rendered considerable assistance to the agricultural court of the Exhibition. No information has reached me regarding the farms maintained by the Hon'ble Thakur Kushalpal Singh. The areas cultivated by some members of the Mainpuri Agricultural Association may almost be described as farms. A small farm has recently been started by Thakur Gaya Bakhsh Singh in the Unao district, and it is hoped that similar modest efforts will this year be made in the Jalaun district. In the western circle the Sisauli seed-farm has continued to serve a useful purpose in the supply of seed, and has been of substantial assistance to the department. No information has been received regarding the demonstration farm at Meerut, which is owned by Shaikh Wahid-ud-din, Khan Bahadur. In the eastern circle two farms are maintained by the Raja of Chandapur in Rae Bareli.

Demonstrations.

69. Reference has been made in the debates in Council to the extension of demonstrations either on special farms or conducted by itinerant officers, and it will be convenient to explain here the policy of the department in this respect. The organisation of demonstrations over the widest possible area is an integral part of the policy adopted : but this organisation cannot be brought into existence all at once. On the one hand study at the experimental farm must precede demonstration, and on the other the demonstrating staff must acquire sufficient practical experience to be able to adapt its operations to the varying features of particular localities. At the present time the position is, that suitable subjects for demonstration are available for most parts of the province, and that operations are limited by the number of officials with sufficient experience : as the numbers of these increase, the extension of demonstrations radiating from each agricultural station will steadily follow.

70. The idea of maintaining demonstration farms at Government expense has been deliberately discarded. The essence of successful demonstrations lies in their distribution over the widest possible area, and the expense of an adequate number of demonstration farms would be prohibitive. Again a demonstration farm once established is a quasi-permanent institution, whereas demonstrations are essentially temporary; the ideal demonstration lasts for one season, or at most two seasons ; and it is most unlikely that a steady succession of subjects can be kept up suitable to the soil and other conditions of any particular farm. A farm thus ties the department to one locality and renders it probable that demonstrations will be carried out under unsuitable conditions. The method of conducting demonstrations approved by the department is first to select as many localities as can be managed : then to obtain the use of a sufficient number of suitable plots in these, the land being usually provided through the agency of the landholders, and then to conduct the demonstrations by an experienced official of the department. This scheme is applicable in the absence of any effective agricultural association : where an association exists, the demonstrations are naturally carried out on land provided by its members, as is now being done in Mainpuri ; and this should form one of the most useful functions of an association. But the idea in either case is the same,—the demonstration of a new crop or variety, or of an improvement in agricultural practice, on as large a number as possible of plots selected for their suitability to the particular demonstration.

71. The staff of the central circle has been so fully occupied during the last two years with the preparations for, and the management of, the Exhibition

that it has not been possible to carry out an extensive programme of demonstrations on these lines. As has been said above, demonstrations were carried out by members of the Mainpuri agricultural association, and the use of various implements was shown at the various implement-centres. In the eastern circle the demonstrations have been for the most part confined to methods of sugar-manufacture, the large number of new factories employing the processes recommended by the department calling for as much of the attention of the staff as could be spared from the Exhibition. In these two circles the organisation of demonstrations will receive special attention in the current year.

72. In the western circle more progress can be reported. Systematic demonstrations have been carried out of a simple method of securing proper spacing in sowing maize, which was found to give a material increase in yield when tried at Aligarh. The Deputy Director reports that large numbers of cultivators followed the method which had been demonstrated and he anticipates that its use will now gradually spread on its merits. The use of a reaping-machine was shown last harvest in the Bijnor district, where wages are particularly high: it was much appreciated, and it is expected that several such machines will be at work next year. Other subjects of demonstrations in progress in this circle are the sowing of country cotton in lines, the simultaneous cultivation of maize and groundnuts which form a most promising mixed crop, and the use of cotton-cake as food for cattle.

Honorary Visitors at agricultural stations.

73. A few words may be said here regarding the appointment of Honorary Visitors to the agricultural stations as this measure is intended to form an additional link between the public and the department. The selection of the visitors appointed during the year was placed by Government in the hands of Commissioners of Divisions, and one or more meetings of visitors have been held at each agricultural station to which they have been appointed. I am not yet prepared to express an opinion on the value of this arrangement: a few of the visitors appear to appreciate the position and endeavour to understand the work that is in progress, others are obviously bored, and others again have not yet put in an appearance. Judging merely by the experience of the past year the conclusion must be that the arrangement is of little value, since those visitors who display genuine interest would have come to the agricultural station in any case; but it is possible that more satisfactory results may be obtained as time passes and experience is gained of the classes from whom visitors can most suitably be drawn.

CHAPTER V.

Agricultural Engineering.

Design of implements.

74. Reference has been made in Chapter III to the position of the engineering investigations in progress. As regards the workshop, improvements have been introduced during the year in the construction of the Baldeo waterlift and the bullock-gear pumps which have increased the strength and durability of these implements. Improvements have also been worked out in the boring tools to obviate defects experienced in their practical working.

Power pumping plants.

75. About 200 applications for advice regarding power-pumping plants have been received. Naturally a large number of the proposals proved to be unsuitable owing to the inadequacy of the water-supply, but specifications have been given in between 50 and 60 cases, and 30 projects are understood to be in progress. In a matter like this the start is the difficulty: each engine that works satisfactorily will advertise itself more effectively than could be secured by any other form of publicity, and I trust the start has now been made.

Miscellaneous.

76. The shortness of this chapter must not be taken as a measure of the importance of engineering to agriculture. As has been explained in an earlier chapter the appointment of Agricultural Engineer has been vacant for a large part of the year, while the change of officers which occurred in the autumn and the demands of the Exhibition during the winter were unfavourable to continuous work.

CHAPTER VI.

Publication and Supply of Information.

Bulletins.

77. The following English bulletins were prepared during the year.

No. 24. Note on foot and mouth disease of cattle.

No. 25. Note on the improvement of cattle in the United Provinces.

A revised edition of bulletin no. 6 dealing with the cultivation of lucerne has also been issued; and a new bulletin is in the press dealing with the working of the small sugar factory at Allahabad.

The proceedings of the Agricultural Conference at Allahabad have also been issued.

Pamphlets.

78. Vernacular pamphlets dealing with (1) the potato-moth, (2) the sugarcane grasshopper and (3) ensilage have been issued during the year: the two former are illustrated with coloured plates prepared by the Imperial Agricultural department.

Scientific papers.

79. The following papers have been published from the chemical laboratories during the year.

(*a*) A glucoside from *Tephrosia purpurea*. Transactions of the Chemical Society of London, Volume 97,1910.

(*b*) Experiments on the cultivation of sugarcane at the Partabgarh experiment station 1908-10 (Pusa Bulletin in press.)

The following have been prepared in the botanical laboratories.

(*a*) Experimental studies in Indian cottons by H. M. Leake (Proceedings of the Royal Society, B., Volume 83, 1911).

(*b*) Note on the incidence and effect of sterility and cross-fertilization in the Indian cottons, by H. M. Leake and Ram Prasad (Memoirs of the Indian department of Agriculture, in press.)

(*c*) Studies in Indian Cotton by H. M. Leake (*Journal of Genetics*, Volume I, No. 3).

Periodicals.

80. The only article from the department which appeared in the *Agricultural Journal* during the year was one by Mr. Burt on the agricultural exhibits at the Lahore exhibition: the July number is expected to contain an article by Mr. Burt on the exhibition sugar-factory and one by myself on the agricultural conference.

Vernacular Agricultural Journals.

81. The vernacular Journal *Mufid-ul-mazarain* has slightly increased its circulation during the year, and a satisfactory feature has been the receipt of a larger number of articles for publication from writers unconnected with the department. The inclusion of a few illustrated articles on insect-pests has continued. The assisted agricultural journal, *Dehati*, published in the Nagri character, has appeared regularly during the year, and has reproduced in its columns most of the articles published in *Mufid-ul-mazarain*.

Correspondence.

82. The agricultural enquiries received in the western circle showed a substantial increase (from 574 to 848) over the preceding year. As regards the other two circles it is impossible to give comparative figures because so many enquiries were dealt with personally at the Exhibition and time did not permit of a record being kept of these. The staff of the eastern circle were often busy throughout a large portion of the day in answering enquiries connected with sugar manufacture, while the officials on general duty were equally busy in dealing with enquiries on almost every conceivable branch of agriculture. The Deputy Director in charge of the central circle informs me that there was a marked improvement in the quality of the written enquiries received during the year; a large proportion of the correspondents made reasonable enquiries of practical importance, and there were comparatively few of the vague and general letters that mark the armchair correspondent.

CHAPTER VII.

Miscellaneous.

Conclusion.

83. The foregoing chapters contain an account of the chief activities of the department during the year under report, and it remains to me only to express my acknowledgements to the officers of the department, and to the executive and clerical staff, for their services during the year, and to the non-official gentlemen who have once again contributed so materially to the supply of information on matters affecting the agriculture of the province.

I have the honour to be,

Sir,

Your most obedient servant,

W. H. MORELAND,

Director.

APPENDIX.

Note on arboricultural operations during 1910-11.*

Summary of work done.—A length of 115 miles was planted with new trees on provincial roads and 245 miles on local roads : the working plans provided for 121 and 218 miles respectively. On local roads the increase over the working plans is due to the plantation of 40 miles of road-side avenues by private individuals, the districts being chiefly Rae Bareli (19 miles) and Basti (15 miles). As a rule district boards adhered to their working plans, but divergencies occurred in several districts from various causes. The chief cause was the necessity for filling gaps in existing avenues : subsidiary causes were the shortage of labour and excessive rains. In only one case (Dehra Dun) does there appear to have been serious mismanagement. In two districts extra lengths of avenue were planted to make up deficiencies in the previous year. The planting of unsuitable trees has practically ceased.

Extension of avenues.—The reports received during the year show that eight miles of " paper avenues " have been further removed from the records, while 365 miles of recent planting have been added as established.

Training class for supervisors.—The training class for supervisors opened as usual in April last at the Government horticultural gardens, Lucknow, and is being attended by seven students sent to it by district boards.

Financial results.—The receipts and expenditure on provincial roads aggregated Rs. 30,017 and Rs. 66,506 respectively : the figures for the previous year were Rs. 25,729 and Rs. 59,676. The net cost to Government was Rs. 36,489 as against Rs. 33,947 in the previous year: the increase is mainly due to the enhanced cost of protection. The expenditure on local roads was Rs. 1,00,853 or Rs. 2,848 more than in the preceding year. The receipts rose from Rs. 50,261 to Rs. 69,762. The increase is chiefly due to the sale proceeds of babul trees in the Meerut district.

The attention of the Director of Telegraphs in charge of the United Provinces circle was drawn during the year to the increasing injury caused to road-side trees in civil stations, and to a less extent along country roads, by the defective methods adopted in clearing the lines for telegraph and telephone wires. The Director has courteously agreed to issue instructions regarding lopping on the lines of those contained in the manual of arboriculture.

*The draft of this note has been contributed by the Deputy Director of Land Records.

REPORT

ON THE

Administration of the Department of Agriculture

OF THE

UNITED PROVINCES OF AGRA AND OUDH

FOR THE YEAR ENDING 30th JUNE 1912.

ALLAHABAD:

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1912.

(Prescribed maximum limit of the report, 20 pages.)

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6th	30th	6th	hotest	hottest
11th	57th	1st	Dr. Part	Dr. Parr

REPORT

ON THE

Administration of the Department of Agriculture

OF THE

UNITED PROVINCES

FOR THE YEAR ENDING 30TH JUNE 1912.

No. $\frac{1165}{V-545A}$ OF 1912.

FROM

THE HON'BLE MR. H. R. C. HAILEY, I.C.S.,
OFFICIATING DIRECTOR, DEPARTMENT OF
LAND RECORDS AND AGRICULTURE,
UNITED PROVINCES,

To

THE CHIEF SECRETARY TO GOVERNMENT,
UNITED PROVINCES, REVENUE DEPARTMENT,
NAINI TAL.

Dated Lucknow, the 16th September 1912.

SIR,

I HAVE the honour to submit the report on the administration of the Department of Agriculture for the year ending 30th June 1912. The scope of the report and the arrangement of its chapters are the same as in the last report.

CHAPTER I.

PREFATORY.

Officers of the staff.

2. Mr. W. H. Moreland, C.S.I., C.I.E., remained in charge of the Department till the 7th November 1911, when he was placed on special duty. He completed his work in the beginning of July, when he went on leave. Mr. Moreland, on being placed on special duty, was relieved by Mr. E. A. Molony, who retained the charge of the Department till 20th December 1911, when he was relieved by me.

Mr. B. C. Burt, Deputy Director of Agriculture, remained in charge of the Central Circle throughout the year, except for a period of three months, from 28th July to 28th October 1911, during which he was on privilege leave, and his duties were entrusted to Mr. H. E. Annett, Officiating Principal of the Agricultural College, Cawnpore. Dr. A. E. Parr, Deputy Director of Agriculture, held charge of the Western Circle throughout the year.

Mr. A. W. Fremantle, Principal of the Agricultural College, Cawnpore, returned in October 1911 from leave combined with vacation and took over charge of his duties from Mr. H. E. Annett. Mr. H. M. Leake, Economic Botanist, returned on 19th August 1911 from leave combined with a short period of deputation and held charge of his office throughout the rest of the year. Mr. G. Clarke retained the charge of his office throughout the year and in addition to his own duties carried on the current work of the Economic Botanist till the latter's return. Mr. Wilson, who was appointed as Assistant Economic Botanist to ensure continuity in Mr. Leake's research work, joined his appointment on 26th January 1912.

3. There was no Agricultural Engineer attached to the Department during the year, but Mr. F. H. Vick, Officiating Superintendent of the Roorkee Workshops, was permitted by the Chief Engineer to assist the Department with his advice in technical matters. Application has been made to Government for the permanent appointment of an Agricultural Engineer to the Department.

4. The Personal Assistant, Khan Bahadur Mir Saiyid Husain, held his post throughout the year, except for a few days in July 1911 when he was on privilege leave. Khan Sahib Saiyid Zamin Husain, B.A., held charge of the Eastern Circle up to 14th August 1911, when he was relieved by Mr. L. C. Sharma, M.R.A.C., P.A.S.I. Saiyid Zamin Husain then reverted to his post as temporary Assistant Director. In November following he was appointed as second Assistant Director.

5. M. Akhtar Muhammad Khan, Deputy Collector, remained on special duty in the Department throughout the year for the purpose of investigating the commercial prospects of sericulture in these provinces.

6. Mr. W. Hulme, whose services were placed at the disposal of the Government as Sugar Engineer by the Government of India, joined the appointment in February 1912. He returned to England on the 9th of May 1912.

Tours of officers.

7. Mr. Moreland, during his rains tour, visited Shahjahanpur in connection with the steps taken to develop sericulture; and then went on to Simla to discuss questions of improvement of sugar manufacture. The rest of his tour was mainly connected with Land Records matters. In November, after conducting the training class for young civilians, he attended the meeting of the Board of Agriculture at Pusa. Mr. Molony also attended the Pusa Conference, and then went on an extended tour through Fatehgarh, Mainpuri, Etah and Aligarh to inspect the results of the well boring in those districts.

8. After a tour through the Muttra district, which was mainly connected with the revision of the settlement, I visited Bareilly and Shahjahanpur to examine sites for a sugarcane farm. I accompanied Mr. Hulme to Babnauli in the Gorakhpur district, and Pilibhit, in connection with the opening of sugar factories; and visited Kashipur, in connection with the extension of cotton growing in that neighbourhood.

9. The Deputy Director, Central Circle's tour included attendance at the Board of Agriculture at Pusa in November, and a visit to the Bombay Presidency for the purchase of cotton seed. Other tours were mainly confined to his circle and included a week spent in the Etawah court of wards estate to advise on agricultural improvements, another week in visiting the villages associated in the Gauria Kalan co-operative society, and visits to various agricultural shows. The Deputy Director, Western Circle, toured through his own circle with the object of superintending the demonstrations in progress. He also attended the Bulandshahr and Muzaffarnagar agricultural shows. The Assistant Director, Partabgarh, was fully occupied in visiting the farms and seed dépôts of the circle, and in inspecting the sugar factories with which the department maintained its connection.

10. The Economic Botanist spent more time than usual on tour, being mainly engaged in selecting a site for the Aligarh seed farm and making arrangements for starting work. The Agricultural Chemist paid short visits to various stations to inspect sugarcane experiments and spent a month at the Partabgarh Agricultural station on research work in sugar. In April he proceeded to Lyallpur at the request of the Punjab Government to conduct the diploma examination in Chemistry at the Punjab Agricultural College.

Special features of the year's work.

11. The year has witnessed an expansion of the operations of the department in several important directions. The research work of the Economic Botanist and the general work of the Central Circle have hitherto been hampered by the small size of the Cawnpore Farm. Though it sufficed for experimental work, it did not afford enough space for the trial of selected types on a large scale, and was too small to serve as a centre of seed distribution. These limitations were specially felt in work on cotton improvement. Two new farms have been opened, one in the Aligarh district in which extended trial will be given on a field scale to the types of cotton on which the Economic Botanist is working; and the other near Cawnpore which will serve as a distributing centre for the cotton selected by the Deputy Director, Central Circle, as most suitable for his circle.

12. Hitherto there have been no farms in the principal sugar growing tracts of the provinces. Though experimental work has been carried out on a small scale at the Aligarh and Partabgarh farms, it has not been conducted under the most favourable conditions, or those typical of the best sugar growing areas. A new

farm is being opened near Nawabganj in the Bareilly district, which will permit of selection for distribution purposes of the best indigenous types and trial of exotic varieties. The farm stands in one of the richest cane-growing tracts of Rohilkhand.

13. For some time past the Agricultural Chemist of these provinces has been conducting a survey of indigenous canes, mainly with a view to determine their sucrose content. This work has been carried out at the Partabgarh agricultural station in which there is comparatively little ground suitable for sugar growing. Though it has sensibly increased our knowledge of the value of different indigenous types, yet, owing to the conditions under which it was undertaken it was limited in its scope and necessarily left important problems of sugar improvement untouched. There are a number of problems—such as the best cultural methods of indigenous canes, the feasibility of popularising exotic canes under existing conditions for sugar making, and the economical cultivation of our thick *paunda* canes—on which a great deal of work remains to be done and somewhat indefinite notions prevail. In order to provide the Agricultural Chemist with a more suitable field for investigating these and similar questions, a small farm is being opened in the Shahjahanpur district, which will also serve as a demonstration farm for sugar growing to the neighbourhood.

14. The earliest agricultural stations opened in these provinces were in the cotton growing districts and were established with the main idea of cotton improvement. Of recent years the question of improvement of sugarcane has been forced imperatively to the front by the heavy importations of Java sugar, and the consequent necessity of trying to meet this competition by better methods of cultivation. With the opening of the two farms mentioned above, a definite step has been taken in this direction. It is not intended that the Nawabganj farm shall be entirely confined to sugar growing, and it will afford an opportunity of studying some of the problems of the submontane districts, which differ very materially in their climatic conditions and characteristic crops from the drier tracts of the Doab. Another agricultural station to complete the chain throughout the provinces is required at the other end of the submontane tract, viz. at Gorakhpur. This district has over a lakh of acres undercane and offers the best chance of effecting improvement in sugar cane growing, owing to the presence of factories in the adjoining districts of Behar, and the prospects of the establishment of similar factories within its borders.

15. The demand for an increase in the number of farms continues and requests have been received for their establishment in several new districts. With most of these demands it is neither possible nor even desirable to comply. The desideratum appears to be one agricultural station in each of the typical tracts into which the provinces naturally fall, with one or more seed farms in the adjoining districts for seed distribution. Whether or not these seed farms are maintained and managed by the department must depend on circumstances. Both the court of wards and private individuals could do a good deal to assist in their maintenance. As a rule it is not desirable to introduce more than one type of each class of crop into tracts with homogeneous conditions, and for this purpose nothing more than a seed farm is ordinarily required in the districts attached to the agricultural station.

CHAPTER II.

Agricultural Education.

The Agricultural College.

16. The college and research laboratories were formally opened by His Honour Sir L. A. S. Porter, Officiating Lieutenant-Governor, on the 11th November 1911. Work had been carried on for some time previously in the building, and teaching has been greatly facilitated by the excellent laboratories with which it is equipped. A combined library for the college and technological institute is being constructed which will prove a great convenience.

17. The course of studies at the college remained substantially unchanged throughout the year. At the diploma examination held in March 1912, 26 out of the 30 students who appeared at the examination obtained a diploma of Licentiate of Agriculture. These results were somewhat better than in the previous year. Four distinctions were given—one in Biology, two in Chemistry and one in Agriculture. The leading student was appointed to the post of Naib Tahsildar.

The examinations were conducted by officers of the department in conjunction with two outside examiners, one from the Agricultural College, Punjab, and one from the Agricultural Research Institute, Pusa.

18. The college is made up of nominees for the subordinate revenue service, candidates for the Agricultural service, and a certain number of private students. The number of the former, probably owing to the imposition of fees and the enlargement of the course, has fallen off considerably and little scope for selection remains. Nearly all the candidates for the Agricultural department who obtained their diploma were taken into the service. The number of private students varies little from year to year. Probably the majority enter the college in hopes of obtaining Government employ. That their numbers do not increase must in a measure be attributed to the small salaries offered as land agents on their leaving the college. In most of the applications received for the services of land agents, the pay offered afforded little inducement to undergo a three years' course at the college, and the preference for Government service is readily intelligible.

Other agricultural training.

19. In consequence of a question asked in council the possibility of giving a training to *karindas* (rent collectors) was considered. The matter involved considerable difficulties, as the education must necessarily be in the vernacular and separate from that of other students, while additional accommodation would be required. To be of any value it must be extended over some period, it is doubtful whether a sufficient number would be willing to undergo the training, or if the additional pay they would receive would compensate for the expenses incurred.

Applications are occasionally received from small zamindars and others for a practical training in Agriculture. To meet such cases the Deputy Director, Central Circle, admitted a small number to the Cawnpore farm to enable them to gain an acquaintance with the methods pursued.

20. The rural education committee decided last year to introduce a series of object lessons into village schools dealing with insect life. The eri-silk worm was chosen as the most suitable subject and introduced experimentally into some of the schools of the Shahjahanpur district, under the instruction of M. Akhtar Muhammad Khan, the Sericultural officer.

Sugar Schools.

21. An important step was taken by Government for securing the training of engineers and sugar boilers for sugar factories. A grant was made to the owner of a factory at Pilibhit, one of the conditions of which was that he should receive for training a certain number of apprentices approved by Government. A serious obstacle in the way of capitalists anxious to introduce sugar manufacturing machinery is the difficulty of finding trained men to be placed in charge. This arrangement will permit a certain number of young men to gain a practical acquaintance with the working of the machinery and with factory methods.

Horticultural education.

22. The courses for training in horticulture organized at Lucknow and Saharanpur continued on the same lines as before. There are now four students in the overseer class at Saharanpur. Five passed out at the end of the year, of whom two were stipendiary and three honorary students. The two former were appointed to posts in the Government gardens in these provinces. All the honorary students obtained appointments to gardens in other provinces, or native states. Looking to the small number of overseer gardeners who can be annually absorbed in the Government gardens, it becomes a question whether provincial classes do not involve a certain waste of effort, and whether joint classes either at Saharanpur, or elsewhere, would not be preferable. The classes for head gardeners (chaudhris) were full and there is a ready demand for their services. There is an even greater demand for malis ; no less than 93 applications having been received for the 13 men available at the Saharanpur gardens.

CHAPTER III.

Research and Experiment.

23. Of the sub-divisions suggested by the Government of India for this chapter, there is nothing to report under entomology and mycology. There is

no research work carried out under these heads, assistance being given as required by officers of the Imperial department.

Agriculture.

24. Experimental work was carried out at most of the Agricultural stations. The experiments at the Cawnpore farm are mainly of a permanent character, and have been carried out for a number of years. They include experiments to test the value of different kinds of manures, the study of various rotations, and investigations of the results of continuous cropping. The study in the amount and composition of drainage water, carried out in conjunction with the Imperial Agricultural Chemist, has been continued; but the experiments regarding the optimum quantity of canal water for different crops were closed, as sufficient information was considered to have been obtained.

Other experiments were undertaken to test the suitability of different types of Pusa wheats to the locality, and to select one or more types of *desi* cotton suited to the conditions of the circle. One of the problems of this circle is to find a cotton for the large unirrigated areas; and experiments were continued with a very promising selection of the Economic Botanist. Tests were also made of various strains of American cotton and endeavours made to isolate a pure type. Extended comparisons of different varieties of groundnut have proved the type distributed to be the heaviest yielder; and further experiments are now confined to determine the most suitable rotation for the crop.

At the Orai farm experimental work was mainly directed to finding a class of wheat less susceptible to rust than the local varieties. A durum wheat has been selected which gives very promising results and it is being tested on a larger scale in different parts of Bundelkhand. The endeavours to acclimatise rice have been abandoned as they held out very little prospect of success.

An area of about 19 acres of ravine land has been taken up near Cawnpore, and the lease of a larger area has been arranged for, to ascertain the feasibility of establishing babul plantations on such land and to gain definite information as to the cost of maintenance and best methods of sowing.

25. There was less need for experimental work at the Aligarh farm as the definite superiority of certain varieties had been established. Experiments were continued with a yellow flowered type of *desi* cotton which though inferior in yield has a better staple than the selected white flowered.

Other experimental work included the testing of different methods of cultivation, particularly of wheat and cotton and maize. One of the most important of these experiments was as to the value of hot weather ploughing for wheat, which gave results at variance with those obtained at the Cawnpore and Bundelkhand farms. Considerable allowance must be made for the difference in the character of the soils, that of the Aligarh farm being of a much lighter description. The results, as the Deputy Director points out, indicate the necessity for an extended trial of this method of cultivation before it is generally recommended. Considerable success was attained with the experiments on deep sowing of early planted maize as a measure of protection against drought and strong winds.

26. The principal work at the Partabgarh farm was the testing of the different varieties of canes as sugar yielders which was carried out in conjunction with the Agricultural Chemist. In addition to this, experiments were conducted to investigate the commercial value of different varieties of san hemp and the possibility of growing jute. Some work was also done on rice and maize with hopes of finding improved varieties suitable to the district.

Chemistry.

27. The principal investigations of the Agricultural Chemist are those referred to above in connection with sugarcane. In addition to these an investigation has been conducted as to the effect of the different methods of planting on the yield and quality of the sugarcane.

An investigation of the organic phosphorus compounds of wheat and other plants is being carried out; some compounds have been isolated which it is hoped may throw light on the cause of variation in the quality of flour.

28. An important investigation was undertaken by Dr. Leather, the Imperial Agricultural Chemist, in conjunction with the officers of this and the Irrigation department into the nature of certain alkali patches in canal-irrigated districts, and the possibilities of reclamation. The inquiry also extended to certain

vexed questions regarding the spread of such patches and the possible effect of canal irrigation in inducing them. Arrangements have been made to keep particular spots under observation in hopes of elucidating these questions.

29. Cotton and wheat form the principal subjects of investigation by the Economic Botanist.

Botany.

The cotton work is a continuation of the plant breeding work which has been in progress some six years. The acquisition of a farm in the Aligarh district will permit of the testing on a field scale of the improved types fixed in the course of operations at Cawnpore.

Wheat work comprised tests of the Pusa wheats under canal irrigation and also a survey of the provincial wheats, a large section of which is now complete. The experiments on the influence of environment on the milling and baking qualities of wheat in India, which are being conducted in co-operation with the Imperial Economic Botanist, have been continued.

30. M. Akhtar Muhammad Khan, Deputy Collector, the officer placed on special duty to examine the commercial possibilities of eri-silk worm breeding, has continued his work throughout the year at Shahjahanpur. So far the worms have been found to thrive and have been comparatively free from disease. The difficulty which was at first experienced in keeping them alive during the hotest months of the year has been overcome by transferring some of the stock to the Kumaun Government gardens; where it has been shown that the worms will provide healthy broods at the beginning of rains. A more serious difficulty is the low price realised for the raw silk which renders it doubtful whether the industry will prove sufficiently attractive to become established in these provinces. With better prices there seems no reason why it should not prove a profitable cottage industry. Very encouraging trials have been made with the mulberry and tussar worms.

Sericulture.

31. The experiments which have been in progress for some years past with a view to producing a suitable design for a percolation well have been brought to a standstill in the absence of an Agricultural Engineer. The need is a serious one as there are large parts of the provinces in which, owing to the absence of a clay foundation, the yield from the wells is small and easily exhausted. An improved design has been framed by Mr. Molony which will be tried when the experiments can be properly directed. For the same reason all experiments with power pumping from tanks and wells have been in abeyance.

Engineering.

32. Mr. Moreland, when on special duty, drew up a note on the cattle supply of these provinces indicating the risks to which it is exposed and the nature of the assistance that can be suitably offered.

Economics.

CHAPTER IV-A.

Assistance to the public.

33. As previously mentioned, the services of Mr. Hulme were placed at the disposal of this Government to study the mechanical problems connected with sugar extraction, and to give assistance to factory owners, or persons intending to establish factories. He spent some time at two factories working in the Pilibhit and Gorakhpur districts, and advised regarding several new projects.

Sugar.

While the question of establishing sugar factories in these provinces undoubtedly excites interest, there is a general tendency to adopt a waiting attitude in the matter. The failure of one or two early ventures has created an unfavourable impression; and those interested in the sugar industry are not apparently disposed to move until they have before them an example of success.

If any further illustration were required for the urgent need of the establishment of factories in these provinces, it is furnished by the events of the past season. The harvest in the Gorakhpur district being a very abundant one, the price of *gur* fell so low that it did not pay to manufacture the cane into *gur*, and much of it was fed to cattle. At the same time Java sugar was selling freely in the bazars.

34. The space available at the farms for sugar cultivation has hitherto been limited, but the Deputy Director, Western Circle at Aligarh, after experimenting with local varieties, has selected the best for distribution purposes. This variety has established itself strongly in the favour of the cultivators of the district. His selected variety of Mauritius cane was also in great demand; in fact the Deputy Director thinks that it will go on spreading until it replaces the local variety of eating cane.

All the seed of Mauritius cane which could be supplied from the Partabgarh farm was eagerly taken up. The Ashy Mauritius cane distributed requires less manure than the *paunda* canes; it also fetches a higher price on account of its superior sweetness.

Cotton.

35. Extended experiments at Aligarh having definitely established the superiority of a white-flowered strain of *desi* cotton, in point of yield and ginning percentage, the Deputy Director is now taking steps to introduce it into his circle. The maximum amount of seed available was distributed this year and as much as possible of the crop will be bought in with a view to future distribution. As there is no doubt about its popularity, there should be in 1913, assuming a favourable seed supply this year, a very considerable area under the crop.

In the administration report of 1910, it was mentioned that, as the existing market was not prepared to pay adequate prices to growers of American cotton, and the Government of India had objected to the financial arrangements under which the department had undertaken its purchase, cultivators were advised not to continue its production until assured of a favourable market. Thanks to the assistance of a Cawnpore firm, the department was this year able to guarantee a remunerative price and about 350 maunds of seed were distributed. Some of this was not sown owing to the unfavourable character of the sowing season, but about 1,200 acres were put down and germinated very satisfactorily.

Attention has been drawn to the Kashipur pargana as a promising field of cotton extension, and a desire was expressed for the assistance of the department to prevent the adulteration of the seed of the local variety, which fetches a rather higher price than ordinary Bengals. A small area on the Tarai and Bhabar Estates farm was planted with local cotton from which selection of the best strain will be made. The management was taken over by the officials of the Government Estates under the guidance of the Deputy Director, Western Circle. The experiment is interesting, because it has frequently been pointed out that external assistance must be given in seed production to permit of the extension of selected strains in compact blocks.

Wheat.

36. Wheat seed was distributed at most of the agricultural stations, and is the most important of the grain seeds distributed from the Oudh Seed Dépôts. The variety mainly distributed was the Muzaffarnagar. This wheat fully maintained its superiority in the Western and Central Doab districts, and gave extraordinary yields at the Aligarh farm. But in parts of Oudh, where the seed has now been distributed for a number of years, it has never won its way to popular favour. It is somewhat late maturing and liable to be damaged by hot winds; it requires more water than the Oudh cultivator can ordinarily give. Its yield is markedly less than in the Western districts. The Economic Botanist has now selected from among the Pusa wheats certain strains which, while yielding well and giving a grain of good milling quality, mature early, and do not require more irrigation than a cultivator who has to rely on his well can give. It is possible that one of these strains may be found suitable to replace the somewhat indifferent wheats of the Oudh districts.

The operations for the supply of wheat seed to parts of Bundelkhand continued. The object is to restore the normal wheat-growing area, which had greatly diminished in consequence of the unpopularity of the crop after the rust years of 1894-5. Some 1,750 maunds were supplied to cultivators, either on payment of cash, or against takavi vouchers. Very considerable success has attended these efforts: in the year under report the wheat area of Jhansi was 89 per cent. larger than in 1908-9 before distribution began.

Seed dépôts.

37. There are now nine seed dépôts in the Eastern Circle, of which five are financed by the department, three by district boards and one by the court of wards. So far as possible

seed is issued on their joint liability to groups of cultivators, who are allowed a rebate on early repayment. In all some 13,000 maunds of clean seed was issued. The financial position of these dépôts is very sound: while retaining sufficient money for future operations, it has been found possible to repay a third of the money advanced to start them. It is hoped that in time this work will be taken over by the Co-operative societies.

Groundnuts.

38. Very striking success has attended the efforts of the department to popularise this crop. The village papers do not as yet show the area under this crop separately and it is not possible to ascertain the total area cropped. It has become very popular within a short time in the Unao, Hardoi and Lucknow districts and parts of Aligarh: the profits realised are so considerable that a further rapid extension is certain. There was a keen demand for seed from all farms; so much so that in the Eastern Circle it was necessary to import a consignment from Bombay to meet it. The villages associated in the Gauria Kalan Co-operative Society have this year sown 600 acres with groundnuts. Probably not less than 20,000 acres will this kharif be under this crop which a few yeas ago was little known in these provinces.

Poultry farming.

39. The Haldwani poultry farm has been maintained during the year. A considerable number of birds of different breeds were imported during 1910-11. Fair success has been met with in raising pure-bred stock, but it has on the whole proved delicate and the demand for such stock has been limited. It is recognised that, to effect any permanent improvement in the general standard of the poultry kept in these provinces, a hardy cross-bred stock must be raised, and considerable progress has been made in this direction.

Sale of implements.

40. There was a somewhat larger demand for agricultural implements at the different agricultural stations. Ploughs were most in request, 637 being sold as against 550 in the previous year. The Meston plough continues the most popular. The above excludes the number of implements sold direct by the firms in Cawnpore, who sell implements recommended by the department. Other implements sold included chain pumps, the Baldeo water-lift and Norag thresher. There was a small demand for kibblers and threshers.

The bulk of the chain pumps were sold as a result of the demonstrations carried out at the Allahabad Exhibition; a considerable proportion going to Sitapur for lifting water from tanks and jhils. At Aligarh a new implement was devised for making irrigation ridges. It is simple in its construction and cheap and a considerable number have been disposed of.

It has been found necessary to close most of the sub-centres, as very few sales were effected. The only sub-centre which disposed of any number to speak of was that connected with the Gauria Kalan Co-operative Society, which sold 32 ploughs. These sub-centres appear only likely to be successful when attached to co-operative societies. A beginning has been made of supplying stocks of implements to these societies to meet their requirements.

41. Arrangements have now been completed by the Deputy Director, Central Circle, with certain firms for the sale at Cawnpore of implements recommended by the department; and two Calcutta firms have opened branches in that city for the purpose. The manufacture of chain pumps and ploughs at the Workshops at Cawnopre has accordingly ceased.

Sheep breeding.

42. With a view to improving the quantity and quality of the wool in the sheep of these provinces and to ascertain how far the importation of such breeds is likely to be successful, a certain number of merino rams were imported from a part of Australia, the conditions of which most closely resembled those of these provinces. Small flocks of country ewes have been purchased and maintained in different parts of the provinces: an attempt will be made to produce a strain of sheep with better wool-bearing qualities which will stand the vicissitudes of the Indian climate. So far the imported animals appear little affected by the change of climate.

Combating insect pests.

43. The sugar hopper has been less in evidence than in previous years and no considerable damage is reported to have been done to the cane.

The potato moth, which appeared two years ago at Lucknow, appears to have spread to nearly all the principal growing centres of the provinces, and great difficulty is experienced in obtaining good seed. Demonstrations have been given at Farrukhabad and elsewhere of the best methods of storing the potato to avoid this pest.

Well-sinking.

44. The well-boring operations were on a somewhat smaller scale than in the previous year. For this the character of the season was partly accountable—a year of favourable rainfall usually leading to a relaxing of effort in well-building—and partly the difficulty in obtaining labour. The latter was seriously felt, and borers remained idle for considerable periods in some districts, owing to the inability of the zamindars to procure the labour required. In some instances the zamindars cancelled their requests for borers on this ground.

The bulk of the work consisted in increasing the supply of water in existing wells; with which object borings were undertaken in 932 wells, as compared with 1,076 in the previous year. The percentage of successful borings was 63 as against 68. The number of trial borings, viz. 250, was about the same as in the previous year. Though the footage allowance was increased, the average speed of boring showed no improvement.

45. Looking to the number of borers employed, it is doubtful whether the department is getting full value for the money spent. Applications come by fits and starts and many of the borers spend weeks of enforced idleness. With men scattered often singly over a large number of districts, it is difficult to exercise proper supervision and to prevent waste of time and material. Some, too, of the borers are consistently employed in the smaller municipalities and their services are thus lost to the agricultural community for whose benefit they are entertained. It may prove possible to concentrate them in larger numbers in districts where there is a steady demand for their services; in which way a much closer supervision could be exercised over their work and arrangements made to avoid the long delays which now take place in replacing or repairing parts of the plant.

CHAPTER IV-B.

Associations, Shows and Demonstrations.

Agricultural associations.

46. One of the principal objects of the encouragement of the agricultural societies is to enable the department to come in contact with groups of agriculturists, instead of individuals. The tendency in these provinces being rather towards the formation of agricultural associations by persons who are not practical agriculturists, the above object can rarely be attained through them. There are exceptions in the Mainpuri Association, a proportion of the members of which are zamindars who cultivate land themselves, and the Walipur Association in the Sultanpur district. The former held regular meetings which the Deputy Director, Central Circle, attended, and organized a successful agricultural show. Some of the members carried out demonstrations and arranged for the supply of seed to their tenants. The Walipur Association gave trials to various new crops and implements recommended by the department. It is generally noticed that the class most interested in agricultural improvement and most ready to take advantage of the assistance offered are the zamindars cultivating land themselves. The voluntary formation of associations by such persons would be welcomed.

Co-operative societies.

47. Many of the co-operative credit societies are in close relations with the department. The Gauria Kalan Society carried out a series of demonstrations, and held a successful agricultural and cattle show. This society now supplies seed to its members and hires out implements. A well-borer was placed at its disposal and the members of the society have kept him fully employed. The societies in the Mainpuri and Hardoi districts have also purchased considerable quantities of seed for the supply of their members. The question is now being considered of arranging with selected members to act as seed growers to the society. In the Western Circle, the Moradabad and Bulandshahr societies have been active in bringing to the notice of their members better varieties of seed and implements.

These societies, as in other countries, are beginning to find the retailing of good seed, while highly advantageous to their members, a profitable business to the society. Up to the present they have been doing a good deal of demonstration on the lines recommended by the department; but as soon as any crop, such as the groundnut, has gained popularity, they are prepared to take considerable quantities of seed. One society has ordered 200 maunds of wheat seed from the department for the coming rabi. In time they should become self-supporting and maintain their own supplies of seed. In the cotton-growing tracts they could perform most useful work by arranging for a supply of hand-ginned seed to their members.

Private farms.

48. The Sisauli farm continues to do good work. This year seed to the value of Rs. 9,509 has been sold. The Raja of Chandapur in the Rae Bareli district maintains a farm on his estate for demonstration purposes and also to supply seed to his tenants.

Agricultural shows.

49. The usual number of shows were held in different parts of the provinces. Some, especially the larger shows in the Western circle, combine a number of different objects; others, such as the shows organized by the Mainpuri association and the Gauria Kalan co-operative society, were purely agricultural and were designed to exhibit the produce of the members' fields. The Hardoi district exhibition was well supported by members of the local co-operative societies. The Khairabad fair in the Sitapur district produced an unusually high class of exhibits. It is generally felt that, as exhibitions of agricultural produce, these shows fail in their object. While new implements, and, above all, machinery attract considerable notice, the exhibits of different forms of produce excite little interest. The time of the year at which they are held, viz., shortly before the rabi harvest, makes it difficult to arrange for satisfactory exhibits. To overcome this difficulty, arrangements have been made to plant Mauritius or other thick canes—which are a never failing source of interest—and other striking crops, in plots adjoining the site of some of the shows.

As the proceedings in Council indicated that these shows are popular and that there was a desire that they should be supported, a special grant has been given by the Government to provide prizes for agricultural and industrial exhibits. It is anticipated that this assistance will not only make the existing shows more attractive, but that agricultural sections will be opened in connection with general fairs in districts where no shows are now held.

Cattle shows.

50. Two cattle shows were held in the Banda district, at neither of which did the exhibits show any improvement on former years. It is generally admitted that, for a variety of reasons, these shows have done little or nothing to encourage cattle breeding. At the same time, there is a complaint of the difficulty in obtaining cattle in parts of the provinces, owing to the falling off in the supply from the Punjab. It seems probable that assistance in keeping up the standard and maintaining a satisfactory supply of cattle could best be given by the establishment, in other parts of the provinces, of cattle farms somewhat on the lines of the Kheri bull farm.

Demonstrations.

51. A good deal of demonstration work has been done in each circle. In the Central circle, demonstrations were mainly carried out through the agency of co-operative societies and court of wards estates. In some cases, individual zamindars undertook to grow special crops or follow particular lines of cultivation. These demonstrations were undertaken with the object of exhibiting the working of agricultural implements, or of demonstrating the value of special methods of cultivation or special varieties of seed. The implements, which form the subject of demonstration, were mainly ploughs, chain pumps or water lifts: the crops were either *desi* or American cotton, wheat and early ripening *arhar*.

The demonstrations in the Western circle followed much the same lines; the main object being to show the superiority of the white-flowered Aligarh cotton, Saretha cane and Muzaffarnagar wheat. Other objects of demonstration were the treatment of *juar* seed with copper sulphate to avoid smut, the value of the proper spacing of maize, and of maize and groundnut grown as a mixed crop. In the Eastern circle the method usually followed was to hold demonstrations on small

plots rented or lent for the season. A successful demonstration of the eradication of the "*rarhi*" weed by deep ploughing was given in the Ballia district; an excellent crop of wheat being raised on the field.

CHAPTER V.

Agricultural Engineering.

52. The post of Agricultural Engineer has been vacant throughout the year. Mr. Vick, Officiating Superintendent of the Roorkee Workshops, continued to assist the department with advice on mechanical problems and technical matters, and also dealt with routine office work. The Deputy Director, Central Circle, took general charge of the workshops at Cawnpore.

53. The vacancy in this post fell at an unfortunate time. The Allahabad Exhibition had excited a very keen interest in power pumping plants, and zamindars and others somewhat recklessly purchased pumps without any regard to the suitability of the machinery for the purposes required, or the capacity of their wells to stand the strain. The result was a number of applications to the department to restore the machinery or the well to working order. Others who were more cautious asked advice on the purchase of power pumps. In the absence of a qualified engineer to inspect the site it was not possible to give, in most cases, the assistance required. It seems more than probable that this is not a mere passing craze. The rise in the price of labour will force the question of power pumping for irrigation purposes to the front and the steady stream of inquiries coming in shows that the need for a change in methods is being felt. To assist this movement, the department requires an engineer not only with a mechanical training but also with a knowledge of well engineering. He must be prepared in the early days not merely to assist with advice in putting the machinery down, but also to keep it in order and provide some training to the men who will work it. Unless some such assistance is forthcoming, the movement, which, to a large extent, owed its initiation to Government action, will inevitably be put back.

Power pumping plants.

CHAPTER VI.

Publicaton and supply of Information.

54. The following English bulletins have been issued:—

Bulletins.

Bulletin No. 26.—Note on the chemical examination of the working of the sugar factory at the Allahabad Exhibition.

Bulletin No. 27.—Note on Surra.

55. Vernacular pamphlets dealing with (1) the cultivation of selected *desi* cotton and (2) American cotton, (3) the moth borer of sugarcane and *juar*, (4) Saretha sugarcane, (5) white-flowered cotton, (6) the bullock-drawn ridge maker, and (7) a revised edition of the groundnut pamphlet were issued.

Pamphlets.

56. The following publication was issued in the botanical section:—

Scientific papers.

Observations on certain extra Indian Asiatic cottons by H. M. Leake and B. Ram Parshad, no. 5, volume 4, of memoirs of the department of agriculture in India, botanical series.

In the Chemical section—the investigation of the effect of different methods of planting on the yield and quality of sugarcane, as bulletin no. 27 of the Imperial Department.

In the civil veterinary department—a note on the indigenous cattle of the United Provinces.

57. Dr. Part contributed the following articles to the Agricultural Journal of India:—

Periodicals.

1. The influence of root development on the tillering power of cereals.
2. A note on white-flowered cotton.
3. A note on the sugar cane experiments carried on at Aligarh.

58. The circulation of the Vernacular journal, the Mufid-ul Mazarain, has decreased slightly during the year; possibly owing to the strict observance of the rule of advanced payment.

Vernacular Agricultural Journals.

The receipt of a large number of articles contributed by private persons for publication continued. Satisfactory editing, so as to make the reading matter attractive, remains a difficulty. The assisted agricultural journal Dehati, published in the Nagri character, has appeared regularly and reproduced many of the articles published in the Mufid-ul Mazarain.

Correspondence.

59. Correspondence continues to jump up at all circles. In the Central circle there were 792 inquiries about agricultural matters and in the Western circle 982. Most of these inquiries came from persons genuinely interested in agriculture.

CHAPTER VII.

MISCELLANEOUS.

Conclusion.

60. The above account forms of itself a sufficient tribute to the energy of the officers of the department. But looking to the extension of the department's activities and the increasing demands constantly being made on the services of its officers, it is doubtful whether these activities can be maintained and demands met without a proportionate increase in the strength of the staff. This undoubtedly forms one of the most important questions affecting the future of the department.

I have the honour to be,

Sir,

Your most obedient servant,

H. R. C. HAILEY,

Officiating Director.

APPENDIX.

NOTE ON ARBORICULTURAL OPERATIONS DURING 1911-12.*

Summary of work done.—New trees were planted along a length of 76 miles on provincial and of 162 miles on local roads, while the working plans provided for 90 and 176 miles, respectively. Out of the 162 miles planted along the local roads, 23 miles were planted by private individuals in eight districts, Basti contributing 9 and Rae Bareli 5 miles and six other districts smaller lengths. The majority of the districts carried out their working plans, but there was a deficiency in 11 districts on provincial roads and in 15 districts on local roads. Explanations have been received in all cases except one (Moradabad). In ten cases the deficiency was due to actual drought or to the unfavourable nature of the season, the rains coming too late for all the trees provided for to be planted. In nine cases funds were diverted to the nursing of young plants or the filling of gaps and in one other the plan had to be revised. In three districts (Agra, Jalaun and Bahraich) trees were planted in excess of the plan. In one district (Fatehpur) the full amount of new planting could not be done for want of trees which had to be procured from long distances. The planting of unsuitable trees has practically ceased: only in Etawah and Mainpuri were such trees planted to any appreciable extent.

Extension of avenues.—The reports received during the year show that 23 miles more of "paper avenues" have been removed from the records, while 194 miles of recent planting have been added as established.

Training of supervisors.—No training class for supervisors was held during the year owing to the absence on leave of the permanent Superintendent of the Government Horticultural Gardens.

Financial results.—Expenditure on provincial roads rose from Rs. 66,506 to Rs. 71,976, while receipts fell from Rs. 30,017 to Rs. 25,180. The net cost to Government was thus Rs. 46,796 as compared with Rs. 36,489 in the preceding year. The increase in expenditure was chiefly due to the extra expenditure on protection under the head of servants, while the decrease in the receipts was the natural result of drought which affected the fruit crops. The expenditure on local roads was Rs. 1,03,742 or Rs. 2,889 more than in the preceding year. The receipts fell from Rs. 69,762 to Rs. 69,288 and is due to the same causes as on provincial roads.

*The draft of this note has been contributed by the Deputy Director of Land Records.

REPORT

ON THE

Administration of the Department of Agriculture

OF THE

UNITED PROVINCES OF AGRA AND OUDH

FOR THE YEAR ENDING 30th JUNE 1913.

ALLAHABAD:
PRINTED BY F. LUKER, SUPDT., GOVERNMENT PRESS, UNITED PROVINCES.
1913.

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Page.	*Para.*	*Line.*	*For—*	*Read—*
10	38	1	brought	bought
10	39	6	district	districts
15	57	1	were	was

ERRATA.

Page. *Below appendix.*

17. *Read* "Note on arboricultural operations during 1912-13."

ib. *Read* as foot note "The draft of this note has been contributed by the Deputy Director of Land Records."

Report on the Administration of the Department of Agriculture of the United Provinces, for the year ending 30th June 1913.

No. $\frac{55}{V-687A}$ OF 1913.

FROM

THE HON'BLE MR. H. R. C. HAILEY, I.C.S.,

DIRECTOR OF LAND RECORDS AND AGRICULTURE,

UNITED PROVINCES,

TO

THE CHIEF SECRETARY TO GOVERNMENT,

UNITED PROVINCES, REVENUE DEPARTMENT.

Dated Lucknow, the 14th of October 1913.

SIR,

I HAVE the honour to submit the report on the administration of the department of Agriculture for the year ending 30th June 1913.

CHAPTER I.

PREFATORY.

Officers of the staff.

2. I remained in charge of the department throughout the year. Mr. B. C. Burt held charge of the Central Circle during the whole year and officiated as the Director of Industries in addition to his ordinary duties. Dr. A. E. Parr, retained the charge of the Western Circle till 19th June, when he proceeded on three months' privilege leave, and Rai Sahib B. Ganga Prasad, the senior member of the subordinate agricultural service of the circle, was entrusted with its charge. Mr. A. W. Fremantle remained in charge of the office of the Principal, Agricultural College, Cawnpore, throughout the year. Mr. H. M. Leake, Economic Botanist, proceeded on 10 months' combined leave on 30th April 1913, previous to which he held charge of his office. Mr. G. Clarke held charge of the office of the Agricultural Chemist throughout the year, and in addition to his own duties undertook the management of the combined library of the Agricultural College and Technological Institute, Cawnpore. Mr. W. Wilson held charge of his office of the Assistant Economic Botanist till he was appointed to officiate for the Economic Botanist on the latter going on leave.

3. The post of the Agricultural Engineer was sanctioned by the Secretary of State during the year, but sanction has not yet been received to the proposals submitted for filling the appointment. Mr. F. H. Vick continued, however, as before, to assist the department in technical matters, and the general supervision of the workshop was undertaken by the Deputy Director of the Central Circle.

4. Khan Bahadur Mir Saiyid Husain, my Personal Assistant, held charge of his post throughout the year. The post of the Assistant Director in charge of the Eastern Circle was held by Mr. L. C. Sharma, M.R.A.C., P.A.S.I., throughout the year and that of the 2nd Assistant Director by Khan Sahib Saiyid Zamin Husain till 9th May 1913, when he left the department to take up his new appointment as Deputy Collector.

5. M. Akhtar Muhammad Khan, the Deputy Collector attached to the department for the purpose of investigating the commercial prospects of sericulture in these provinces, remained in charge of his work throughout the year.

6. Mr. W. Hulme, whose services were placed by the Government of India at the disposal of this Government as Sugar Engineer, returned from England on

13th October 1912; and, after completing the second term of his appointment, went back on 21st March 1913. He has been appointed for three seasons only, but application has been made to Government for the retention of his services for a further period.

Tours of officers.

7. I was on tour for 5 months and 3 weeks during the year in course of which I visited the agricultural and cattle farms and arranged sites for two new seed farms and the cattle farm at Muttra. I also camped through the Jalaun district in connection with the revival of cotton-growing in that tract, and through the Lucknow and Sitapur districts to inspect the well-boring operations.

8. The Deputy Director, Central Circle, accompanied the Director on tour through the Jalaun district. Other tours were confined to inspections of farms and demonstration plots in his circle, with the exception of inspection visits to the Technical Schools in his capacity of Director of Industries. He also attended the agricultural exhibitions at Etawah, Mainpuri, Hardoi, Gauria Kalan, and Takia.

The Deputy Director of Western Circle spent a good deal of time on tour in connection with the opening of a new agricultural station in the Bareilly district and seed farms at Agra, Muttra, and Kashipur. He also attended the agricultural exhibitions at Saharanpur, Moradabad, and Bulandshahr.

The Assistant Director's time was fully occupied in developing the Benares farm and visiting the demonstration work and seed dépôts of his circle. He also paid visits to the different sugar factories with which the department had maintained its connection with a view to clearing up the accounts.

9. The tours of the Economic Botanist and Assistant Economic Botanist were mainly confined to visits to the Kalai farm, where a great deal of work remained to be done in bringing the new farm into working order. The Agricultural Chemist visited Aligarh in January to carry out the systematic testing of the collection of sugarcanes made by the Deputy Director, Western Circle. February was spent in tours at Partabgarh and Shahjahanpur. At the former station the experimental work and analysis in connection with the sugarcane of the eastern districts were completed. At Shahjahanpur the preliminary work in connection with the laying out of the new sugarcane farm was undertaken and the plans for the testing room, office, and farm buildings worked out, and collection of indigenous and foreign cane started. Further visits were made to Shahjahanpur during the spring and summer. In May he proceeded to Lyallpur to carry out the examination of the Punjab College.

Extension of operations of the department.

10. The chain of agricultural stations with dependent seed and demonstration farms is gradually being extended over the provinces. Taking the cotton-growing tract, there are now in the Aligarh district two central stations—the Aligarh farm, which is the head quarters of the circle, and the Kalai farm, which is devoted to research work and cultural experiments under the charge of the Economic Botanist. Attached to this circle there are seed and demonstration farms in the Agra and Muttra districts, dealing with cotton and wheat. There is also a farm at Kashipur in the Naini Tal district, where cotton only is grown. In the current year it is proposed to open a similar farm in the Bulandshahr district and from thence extend to the Upper Doab.

In the Lower Doab, a seed and demonstration farm has been opened near Etawah; where a very suitable site has been found near the town. At Cawnpore, in addition to the head quarters farm, there is a seed farm of 108 acres at Kalianpur. In Bundelkhand, which possesses great possibilities for the extension of cotton-growing, there are the agricultural stations at Orai and Atarra. The former is not well suited for cotton-growing, as it consists mainly of a *kabar* soil, and a demonstration farm has been opened temporarily at Madhogarh which it is hoped to make permanent. At Atarra, future developments must depend largely on the amount of canal water available for hot weather sowings.

11. Under, therefore, the present arrangements the areas in which no farms have been opened are the Upper Doab to which allusion is made above; and the new cotton-growing districts, extending from Unao to Budaun, which stand on the fringe of what may be termed the cotton-growing belt. In the latter districts no

irrigation is available and the cultivation of the crop is very irregular. So far as the Unao district is concerned the close connection of the department with the well developed co-operative societies renders any demonstration or seed farms unnecessary; this work being undertaken by the members of the societies under the direction of officers of the department. Arrangements of a similar nature are being made with the societies in the Hardoi district. The whole ground is thus being gradually covered.

12. In the submontane tracts an agricultural station has been opened at Nawabganj in the Bareilly district, which will deal with the principal products of that tract, sugarcane and rice. The equipment of the farm is not yet complete and there has so far been no opportunity of studying the canes or classes of rice most suitable to the neighbourhood. As soon, however, as experimental work has proved the superiority of definite types, the same process of establishing demonstration farms for their popularization and the distribution of seed will be followed as in the cotton-growing areas.

As was mentioned in last year's report, the Partabgarh farm was found to be unsuitable for the work undertaken by the Agricultural Chemist who is conducting a survey of the indigenous canes. A small farm has accordingly been opened in the Shahjahanpur district; mainly for research work and cultural experiments with sugarcane. Proceeding eastward, the sugarcane crop diminishes in area and relative importance until the Gorakhpur division is reached, in which it is widely cultivated. This division, owing to its geographical situation and the enormous size of the circle, has to a large extent remained outside the sphere of operations of the department. It has now been proposed to establish an agricultural station in the Gorakhpur district in which the main agricultural problems of the tract may be studied. This will complete the chain of agricultural stations in the submontane districts.

13. The intermediate country, consisting of a part of Oudh and the Benares division, is served by the two farms at Partabgarh and Benares with their subsidiary demonstration areas. These districts produce a great variety of crops at both harvests, with no largely predominating interests as in the western and submontane districts. The work principally engaging attention is the improvement of the wheat and barley crops and the quality of the hemp fibre which is being produced in largely increasing quantities.

In dealing with the Agricultural farms of the province and their extending operations, mention must be made of the Jumna Mission farm at Allahabad which has been started by the American Presbyterian Mission. Though primarily conducted for the benefit of their converts, assistance and advice is readily given to the cultivators of the neighbourhood. Being situated in a somewhat poor tract of country it should, when fully developed, afford an excellent object lesson in the improvements to be effected by better methods of cultivation.

CHAPTER II.

Agricultural Education.

Agricultural College.

14. There were no important changes in the administration of the Agricultural College during the year.

Turning to the work of the year, the results are fairly satisfactory. At the Diploma Examination held in March 1913, out of 34 students who appeared 24 obtained the diploma of Licentiate of Agriculture. No distinctions were given. The examinations were conducted by officers of the department in conjunction with two outside examiners; one from the Agricultural College Coimbatore, Madras, and one from the Agricultural College Sabour, Bengal.

15. The number of students who entered the college during the current year was 51: of whom 40 were nominees for the subordinate revenue service and 11 were private students or candidates for employment in the Agricultural department. In 1911-12 the numbers respectively were 38 and 8.

16. In order to provide a suitable library for books of reference and scientific works procured for the college and research laboratories, a combined library for the Agricultural department and department of Industries has been

built and is now open. A reading room for current journals on connected subjects has also been provided.

The college grounds have been steadily improved under Mr. Fremantle's fostering care and fittingly set off the handsome building. The condition of the park which forms the approach to the college also reflects great credit on the management.

17. The question of the separation of the Qanungo classes from the Agricultural College has been under the consideration of Government during the year. Under the present scheme of working, the college has failed to turn out a sufficient number of recruits, either for the subordinate revenue service, or the Agricultural department; and both services are very short of men. In the Agricultural department, recruitment to which is limited to diplomates of the college, the shortage amounts to 14 and is seriously felt in a small department. There are other connected questions—such as the difficulty of combining an appropriate course of training for agricultural students and candidates for Qanungoships; the unsuitability of the recruits, who belong mainly to the literary classes, for the agricultural service; the reluctance of certain sections of the public to enter a college, popularly regarded as an institution for training candidates for the subordinate revenue service—which render a separation desirable. Sanction has been given to the opening of a separate school for the training of Qanungo candidates, and the college will in future be devoted exclusively to the education of students seeking instruction in agriculture and its allied sciences.

Other agricultural training.

18. A certain number of agriculturists receive practical training in agriculture at the farms. Some of these men come on their account and stay for varying periods, freely joining in the work of the farm. Others are sent by landlords to obtain instruction in particular methods of cultivation, or the use of special implements. The latter system might be usefully developed. A man of a good agricultural caste, such as a Jat or Kurmi, who has spent some time at the farm will profit more by the instruction given and will be better fitted to introduce improved methods of cultivation than the *karindas* whom it has been proposed to send.

19. At the request of the Etawah district board two village school teachers have been given elementary instruction in practical agriculture at the Cawnpore farm, and three more are expected shortly. These teachers have been provided with plots of land by the zamindars on which the school boys grow, under their direction, the crops recommended by the department.

Horticultural education.

20. There were five students studying in the overseer class at the School of Horticulture, Saharanpur. As the only student who completed the course during the year left for England for a special course in horticulture, no appointments were made to the Gardening service of the provinces. The classes for chaudhris were maintained as usual both at Saharanpur and Lucknow. In both instances the Superintendents report that the classes are not working satisfactorily. The number joining is small, though it is pointed out that appointments are readily found for those who have qualified and the inducements are superior to those offered in many branches of office work. The difficulty appears to be to obtain a fairly well educated class of men, who are willing to perform the amount of manual labour which is necessary to become a trained gardener. The Superintendent, Horticultural Gardens, Lucknow, reports "that the students have an idea that only class work is needed or expected of them and often resign when they find that this is not the case. It is however the practical side of the work they most need to fit them to train others."

There was a good demand for *malis* at both gardens and it was impossible to meet all the applications received. Employment is so readily obtained that many leave the gardens before they become properly qualified.

CHAPTER III.

Research and Experiment.

Agriculture.

21. When the Agricultural department was organized on its present footing, the first work of the newly appointed officers was to examine the existing conditions of agriculture in the provinces to ascertain in what directions improvement could be best effected.

It necessarily followed that the work at first undertaken was principally of an experimental character. It was not until some years had elapsed that the officers in charge of the circles were in a position to recommend varieties possessing definite points of superiority over those ordinarily grown which were obtained either by isolation of pure types, or selection from among indigenous or imported varieties. The work occupied varying lengths of time in case of different crops and in different tracts; but once the selection had been made, the efforts of the officers concerned were mainly devoted to the demonstration of the crop, and the multiplication and distribution of the seed. The Deputy Directors have now a number of these types, which may be termed recommended types, to offer; and there is consequently less experimental work done at the agricultural stations and more demonstration work in the circles. In addition to this, owing to the small size of the farms, some of the land formerly devoted to experimental purposes has now to be given up to the production of seed. Notwithstanding, a good deal of experimental work of various kinds is being carried on at the principal agricultural stations, and both the research officers, viz. the Economic Botanist and the Agricultural Chemist, have separate farms under their own management in which research work and cultural experiments are undertaken.

22. Taking the different farms :—

Central Circle.

Most of the permanent experiments at the Cawnpore farm have now been dropped, as they are not likely to yield further information, the continuous wheat series alone being continued; the results of these experiments will be published shortly.

The testing of the varieties of Pusa wheats received from the Economic Botanist has been continued and one or two of these have now been definitely selected as suitable for particular parts of the circle. In the matter of cotton, attention was mainly devoted at this farm to the selection of the best type among the Cawnpore-American cotton, which is of a somewhat mixed character; and to the selection of a variety of *deshi* cotton suitable to the large unirrigated areas of this circle. The introduction of a satisfactory early flowering plant might make a good deal of difference to the area under cotton in these provinces; as in the unirrigated districts the cultivators will often not sow the crop at all, unless early rains are received. This is very marked in Bundelkhand, where custom, founded no doubt on long experience of the flowering and ripening habit of the plant, has fixed a more or less definite limit for cotton-sowing. The fluctuations of cultivation in these tracts are consequently very extraordinary; and the total area under the cotton crop see-saws in a manner highly disconcerting to those who would see supply meeting demand with machine-like regularity. It may therefore prove that the development of cotton-growing in these tracts, which lie outside the reach of canal irrigation, depends on the substitution of a different type of cotton to that now grown. Two varieties supplied by the Economic Botanist for trial have so far shown themselves very promising. In addition to the above, rotation experiments for cotton and groundnuts, and mixed cropping experiments for the latter are in progress. A number of selected types of *juar* are being tested for suitability to the tract. The value of early ripening *arhar* for sowing with cotton is now established; and, as a result of preliminary demonstrations, the supply of seed is unequal to the demand.

Manurial experiments with cotton are being continued, and some tentative work is being carried out as to the value of artificial manures in rotation for maize, tobacco and potatoes : experiments on green manuring and hot weather cultivation are being continued.

The sub-stations for the cultivation of *babul* on ravine land and for the reclamation of *usar* have been maintained.

Orai and Atarra farms.

23. These farms are situated in Bundelkhand the soils of which differ materially from those of the rest of the provinces. A good deal of experimental work has been undertaken, with a view to ascertaining the most suitable methods of cultivation, and some definite results have been arrived at. It has been found at the farms that the increase in outturn following the application of manures is relatively small, compared with the results obtained by more thorough cultivation and proper crop rotations. This applies particularly

to the darker grades of soils in which the response to manures is small. On the other hand, the advantages of hot weather ploughing were very marked. The difference between the crops grown on the farms and those of the neighbourhood has made a considerable impression ; and, judging from the interest taken in the work on the farms and the willingness of the peasant proprietors to co-operate with the department, so far as their means permit, Bundelkhand appears to offer the most promising field for improvement. The people are, however, slow moving, and a larger staff and more demonstration work is necessary to appreciably extend the influence of the department.

The experiments now in progress for a considerable period have enabled Mr. Burt to select a *durum* wheat, which shows a considerable improvement as regards yield and rust-resisting qualities over the *kathia* ordinary and is rapidly becoming popular with the cultivators. A common *(pissi)* wheat called Malwa has been selected for the irrigated tracts.

The cotton problem in Bundelkhand presents greater difficulties. The canals being fed from reservoirs, irrigation cannot be regularly counted on for kharif sowings. While it is extremely desirable to extend the practice of early sowing on irrigation, a slightly late flowering cotton such as is best suited for early sowing would not be suited for the unirrigated tracts, or for the irrigated tracts in years of short water supply. Experiments are being carried on at the farms with a certain number of cottons which appear likely to suit the Bundelkhand conditions. Experiments with eradicating *kans* by flooding have been dropped ; as it has been shown that they are not likely to produce any satisfactory results, while the weed can be kept under control by deep ploughing.

Western Circle.

24. At the Aligarh farm under the charge of Dr. Parr the main line of experimental work has been towards evolving by selection from among country cottons of a type with superior staple. One fine type has been isolated which is now under trial for yield and ginning percentage. Attempts to obtain by selection an early ripening type of *Buri*, which has done uniformly well at the farm, are being continued.

Comparisons of different varieties of wheat, cotton, sugarcane, and groundnuts were maintained ; but they served only to demonstrate the superiority of the types selected and now being distributed to the cultivators. With these were combined tests of different methods of tillage. The deep method of sowing maize has again given very good results on the farm, and the cultivators are taking it up.

At the Gursikran *usar* sub-station experiments with dynamite gave rather disappointing results. The dynamite was put down into the putty-like clay which underlies the *usar* of the district ; its elasticity seemed to give a deadening effect on the explosive. Much more valuable results were yielded by the system of flooding adopted, and some good crops of rice and barley were obtained. It seems probable that, where water is available, *usar* land can be made to grow a crop which will cover expenses and leave a profit.

The Bareilly farm has only recently been opened and no experimental work could be undertaken.

Eastern Circle.

25. This circle is not so far advanced as the other two in the selection of superior varieties, and the experimental work at the Partabgarh and Benares farms consisted mainly of comparisons of different kinds of wheats, sugarcane, cotton, and rice to test their suitability for the circle. With a somewhat different growing period some of the results contradicted those obtained in other circles. *Buri*, for instance, gave a better yield than the best *deshi* cotton ; while the rabi period seemed to be too short for the full development of Muzaffarnagar wheat.

San hemp is now becoming an important crop in this part of the provinces and comparisons were made of different varieties to test their commercial qualities.

Botany.

26. As before, cotton and wheat formed the chief subjects of investigation by the Economic Botanist. The cotton work is a continuation of the plant-breeding work which has been in progress for some seven years ; the object of which is to produce by

crossing of *deshi* types a variety combining the high yield and ginning percentage of the ordinary *deshi* with an improved staple. The results so far attained have recently been described in an article appearing in the Agricultural Journal of India.

Chemistry.

27. The Agricultural Chemist continued his investigations, in the field, of the constituents of the principal canes of the provinces. He carried on in the laboratory the investigations referred to in last year's report of the organic phosphorus compounds of wheat and other plants, some of the results of which have been published.

Sericulture.

28. M. Akhtar Muhammad Khan has remained on special duty during the year to examine the possibilities of *eri* silkworm culture. It has been found that, though the worms will not live through the hot weather in these provinces, they thrive on the wild castor growing in the hills, and it is easy to arrange for an interchange of seed. For the last two years broods have been reared at the Government Gardens, Jeolikote. From July to March the worm appears to do well in the plains and the Special Officer believes that with care five broods may be raised before the following April. So far the worms have been comparatively free from disease. The difficulty in developing the industry hitherto has been the low price procurable for the cocoons. There has however been a rise in the price offered and the Special Officer reports that he is now receiving Rs. 100 per maund as against Rs. 80 two years ago. He believes that though rearing of *eri* silkworm on a large scale will never prove profitable, yet it would be a paying industry for cultivators who grow the castor oil plant. They will not however undertake the business without advances. A demonstration farm has been maintained at Shahjahanpur and the worms at different stages of their existence have been shown at the different exhibitions.

CHAPTER IV-A.

Assistance to the Public.

Cotton.

29. The policy previously outlined in connection with this crop has been further developed. The trade generally, in the sense of the middlemen who purchase the cultivators' produce, wants cotton irrespective of quality. It is, therefroe, to the cultivators' advantage to grow a cotton which will give the largest quantity of lint. On the other hand the Cawnpore mills consume considerable quantities of finer staple cotton which they ordinarily import from America or from other parts of India; and they are prepared to pay proportionately higher prices for such a cotton grown in these provinces. The primary object the department must keep in view is the introduction of such crops as are likely to pay the cultivator best under existing trade conditions. This object can at present be best served by introducing a *deshi* cotton with a higher yield and ginning percentage than that ordinarily grown, and at the same time putting out a better staple cotton into a limited area to meet the requirements of the Cawnpore mills. If, as may possibly be the case, the middleman is subsequently prepared to give a satisfactory premium for quality, the machinery for the extension of the area under longer staple cotton will be in existence. In addition to the above, the department is encouraging the extension of cotton cultivation in such parts of the provinces as may be suitable for the crop.

30. In pursuance of these objects the department is putting out a white flowered type of *deshi* cotton isolated by Dr. Parr at Aligarh, which has a heavier yield of *kapas* per acre than the ordinary *deshi*, and at the same time a ginning percentage of slightly under 40 %, as compared with 33% at which *deshi* usually gins out. The ginning outturn at present largely controls the price offered by the purchaser, and the *kapas* from this plant commands a premium of Re. 1 to Re. 1-4 per maund over ordinary *deshi kapas*. When to this is added the higher yield per acre, its popularity with the cultivator can be readily understood. The extended cultivation of the crop was in the first instance necessarily limited by the small amount of seed available of a pure type of cotton, and afterwards by the desirability of confining its cultivation to a definite area. If widely distributed in scattered plots, there was a danger of the type being lost by admixture of seed. Expansion,

therefore, proceeded in a gradually extending radius round a given centre. In the present season it is estimated that there will be about 20,000 acres under this cotton in the Western Circle and some 2,000 in the Central Circle, parts of which are suitable for its cultivation. With the amount of seed now available, expansion is limited only by the strength of the staff and funds placed at the circle officer's disposal.

31. For the longer staple cotton, seed of the Cawnpore-American and Dharwar-American varieties were given out—mainly in the Cawnpore and Etawah districts—on a guarantee from the Elgin Mills of a premium on *kapas*. A crop of about 120 bales was produced, and a comparative spinning test on a commercial scale carried out by the Elgin Mills showed that this cotton was within 5% in value of middling American. In addition to the above a portion of the *kapas* appears to have been sold to local dealers and not to have passed through the hands of the officers of the department. In villages where spinning is still practised good prices are realisable for finer cotton and it is difficult to gauge the extent of this demand. The Dharwar variety proved less suitable for these provinces and has a lower ginning percentage than Cawnpore-American: the issue of the seed of this variety, which is mainly though, as noted above, not entirely controlled by the department, will be discontinued. The Cawnpore-American has been grown for a number of years in these provinces and is thoroughly acclimatised. As there appears some misconception on the subject it may be noted that the average yield in *kapas* of this variety is fully equal to that of the best *deshi;* and after the department had, owing to the absence of an organised market, ceased to distribute the seed, some of the cultivators continued to grow it as a superior yielder. The seed was in fact recovered from these men. It is, however, inferior in ginning percentage; and for this reason the middlemen differentiated against it. Unless, therefore, an improvement can be effected in the ginning percentage, or there is a drop in the present high price of *deshi*, some premium is necessary to render its growing profitable to the cultivator. Its future must to a large extent depend on the price of short staple cotton, which has a separate market on the continent and in Japan from the finer cottons. In the event of a further rise in the price of *deshi* it would not be to the interest of the manufacturer to pay a premium which would tempt the cultivator to grow it. But, as it will always be worth the manufacturer's while to buy at a little less than he can purchase imported lint, a drop in the price of *deshi* might make the cultivation of American cotton very profitable. Five years ago the department could give a premium of Rs. 2 per maund of *kapas* over the price of *deshi;* now it would be almost as cheap to import from America than to pay such a premium.

32. The two most promising fields for the extension of cotton-growing appeared to be the submontane districts and Bundelkhand. For the former, a special cotton which seems to suit the locality is being distributed. Owing, however, to the heavy rainfall in normal years and the expenses of weeding, cultivation is not making much headway.

In the north of the Jalaun district arrangements were made with the Irrigation department for supplying water for early sowings. Some 2,800 acres were put under early sown cotton; and the marked difference between these plants and such crop as could be sown in the rains should lead to a considerable extension of this system in future. The seed issued was procured from another part of Bundelkhand, viz. from the neighbourhood of Kulpahar in the Hamirpur district; as some of the Cawnpore millowners were anxious to extend the cultivation of this cotton on account of its superior qualities. But for the scarcity of seed, a considerably larger area could have been sown. Bundelkhand was formerly one of the principal cotton-growing tracts of the provinces and, if irrigation is available for early sowings from the canals now being completed, the crop is likely to recover its former popularity. As previously noted, the problem of securing more stable and extended cultivation in the unirrigated districts north of the Ganges seems to largely depend on the finding of a suitable early flowering type.

33. In the south-eastern portions of the provinces cotton is mainly grown as a mixed crop and picked at the beginning of the hot weather. The late flowering variety grown is chiefly remarkable for the very small percentage of lint to seed. No great extension of cultivation is probable in these tracts, but a much better yield could possibly be obtained from a different variety of plant and some trials are being made of types selected by the Economic Botanist.

Sugar.

34. The services of Mr. Hulme, the Sugar Engineer, were at the disposal of the department during part of the year. He superintended the remodelling of the Pilibhit sugar factory which had received aid on certain conditions from Government. This factory, which is the first central factory in the provinces entirely owned and worked by Indian capital and labour, had hitherto proved a failure owing to faulty erection of machinery and lack of experience of the staff. Under Mr. Hulme's supervision it was partly reconstructed; some new plant added, and the staff instructed in the working of the machinery. It is satisfactory to be able to record that it had a successful season. With the assistance thus received, Raja Lalta Parshad, the owner of the factory, who had up to last year experienced the disappointments of a pioneer of a new industry, can now reasonably look forward to reaping the profits of his enterprise. The example he has set should stimulate other Indian capitalists to follow in his footsteps, to the great advantage of the industries of the provinces. The area under cane is steadily rising and there will be well over a million and a half acres under the crop this year. It is doubtful if the *gur* market can absorb the enormous output and there has been a marked drop of prices in parts of the provinces during the last two or three years. An increase in the number of properly equipped central factories is very necessary to dispose to the best advantage of some portion of this large cane crop. Mr. Hulme's inquiry has led to the conclusion that there is no possibility of a small plant for sugar-making holding its own in the long run against imported sugar. The small model plant exhibited at the Allahabad Exhibition, though probably the best yet tried in this country, has proved too small to be economically worked. It would appear that the best direction in which small plant can be utilised is in turning out a better raw material for the *gur* refineries. The *gur* consumer demands only a crisp, light-coloured article; the refinery looks to the sugar content, stable and uniform composition. Mr. Hulme is bringing out a small plant for the purpose.

35. The two farms at Nawabganj and Shahjahanpur which deal mainly with cane are getting into working order, but are not yet sufficiently advanced to commence distribution of seedlings. Both experienced considerable difficulties with their water supply which have not yet been overcome. At Aligarh the Saretha and Mauritius canes, which have given good results at the farm, were in great demand. Altogether some 3,600 maunds of cane were distributed. Part of this was supplied from the farm, but most of it from crops grown by the cultivators for the department from seed previously distributed.

In the Central Circle about 30 tons of approved varieties of cane were distributed to co-operative societies and court of wards estates. Demonstrations of the value of an improved pan for *gur*-making were given at the exhibitions and a certain number sold.

36. Mr. Clarke, the Agricultural Chemist, has continued his survey of the provincial canes with a view to ascertaining their sucrose content and purity. In this connection the association of the department with the Pilibhit factory has proved useful. The sugar content of the principal canes brought into the factory was analysed: a daily record kept to ascertain period of ripeness, and their working in the mill studied. The management is thus able to limit the canes grown to a few of the best varieties. Some of the latter have been sent to the Gorakhpur district, where a trial will be made of them for the factory about to be opened in that district.

Wheat.

37. Extended trials having established the superiority of Muzaffarnagar wheat as a yielder in the Western Circle, the seed of this variety continued to be distributed in that circle. The published farm returns show that it gives better results than any other of the kinds experimented with. As, however, was pointed out last year, it is by no means an ideal wheat for all parts of the provinces; and has not proved popular in unirrigated tracts, or where well irrigation alone is depended on. In some tracts, particularly the submontane and parts of Oudh, the wheat yield is low and there is ample room for improvement. Some of the Pusa wheats, which have been selected by the Economic Botanist, seem likely to be suitable to local conditions; as they require less irrigation than the Muzaffarnagar and, ripening earlier, are less exposed to the hot west winds. They have been tried in different court of wards estates with considerable success; especially in the Kheri estates, the Manager of which,

Mr. Hoskins, has taken much interest in the subject. The season was one which rather brought out the qualities of these wheats and for this reason they attracted considerable attention in the eastern districts. A prolonged drought was followed by high winds and storms in February and March. Both nos. 8 and 12 did well with the small amount of water the wells could supply; and, being strong strawed, stood up while the surrounding wheats were laid by the storms. The whole of the available amount of seed has been indented for for the next rabi; and a certain quantity procured from Bihar. The distribution of wheat seed in the Jhansi district was continued with the object of meeting the scarcity of seed resulting from the last rust year. The wheat area has now risen to normal and the distribution will be discontinued. Efforts will in future be directed to putting out a selected *durum* wheat which is a heavier yielder and more rust-resistant than the local *kathia*.

Groundnuts.

38. Though the seed available at the farms was readily brought up, there is no further need for action on the part of the department in assisting the development of this crop. In spite of the drop in prices, it remains very popular and its cultivation is rapidly spreading. About 20,000 acres were under cultivation in the year under report, and the produce appears for the first time among the provincial exports. The cultivators have discovered that the crop thrives on poor sandy soil which is ordinarily sown with *bajra* and requires little moisture. It may frequently be seen on inferior outlying land which is irregularly cropped. Being at present prices very paying, it is thus a valuable addition to the crop system of the provinces. The oil is coming into use as a substitute for *ghi;* and this will help to counteract the inevitable fall in prices as cultivation spreads. The whole of this development has taken place within the last five years and is only another instance of the quickness with which the average cultivator recognises the value of a new crop and his readiness to adopt it.

Soya bean.

39. A *soya* bean with a higher oil content than the indigenous variety was tried in the hills. It does well at a moderate elevation and seed has been distributed on a larger scale this year. Mr. Gill, in charge of the Kumaun Gardens, who kindly undertook the distribution, reports very favourably on the crop. It is also being tried in some of the submontane district with a temperate climate.

Miscellaneous.

40. Large quantities of other seeds were supplied from the farms including, early ripening *arhar*, selected maize, and *juars*. There are now 11 seed dépôts working in South Oudh, of which 8 are financed by the department and 3 by the district boards. One has been made over to the Co-operative Credit Societies. These dépôts work on the *siwai* system. In all some 13,000 maunds of seed were disposed of. The financial position of these dépôts is sound and it is obvious that the co-operative societies could take up this work with much profit.

Sale of agricultural implements.

41. The arrangements made with two Calcutta firms with branches at Cawnpore to stock and retail implements recommended by the department has on the whole worked well. The department now exhibits these implements at the different agricultural exhibitions and registers orders. A certain number are kept in stock at different centres for convenience of purchasers and sold from there, and some are sold from the exhibitions. Under the circumstances the total number sold is not known; but, judging from the orders which have passed through the hands of the officers of the department and sales at centres and sub-centres, the implements principally in demand are ploughs, chain pumps, and sugarcane-crushing mills. Of the former, mainly Meston ploughs, over 500 were sold from Cawnpore. The steady demand for spare shares shows that the ploughs are in constant use. A few of the co-operative societies are now beginning to sell implements to their members.

Experiments were made with a steam thresher and bhusa-maker at the Cawnpore seed farm, the machine used being a modification of one exhibited at the Allahabad Exhibition. The machine was primarily purchased for use at the seed farm, but was afterwards worked at contract rates for zamindars in the neighbourhood. The bhusa made was of good quality and the machine was profitably employed throughout the threshing season. It was found that, allowing for interest,

depreciation, and repairs, threshing could be done at a profit on contract at 6 annas per maund, which is about one-third of the present cost of threshing and winnowing in villages. A second machine of a similar pattern is being ordered out.

A new reaping machine specially designed for black soils was used with satisfactory results and the actual cost of reaping worked out at considerably less than local rates. But though labour is scarce in Bundelkhand and the fields generally of considerable size, no general introduction of these machines is probable owing to the mixed crops grown.

Sheep breeding.

42. As was mentioned in last year's report, sheep-breeding operations have been started with the object of ascertaining if there is any possibility of improving the quality and quantity of the wool of the Indian sheep. Experimental flocks have been formed and located at Aligarh, Moradabad, Bahraich, Kheri, Allahabad, Atarra, Partabgarh, and Lucknow, and merino rams imported from Australia introduced into the flocks. Already some 55 half-bred merino lambs have been born, but it is as yet too early to express any opinion as to the probable success of the experiment. The question of sheep-breeding has been taken up at the Kapurthala estate, Bahraich, and the Jumna Mission Farm, Allahabad; and it is hoped that some general interest may be excited in the matter.

Insect pests.

43. No reports of serious damage by the sugarcane hopper have been received during the year. The potato moth did increased damage in Fatehgarh, where individual merchants lost as much as Rs. 20,000 and potato storage has been largely given up. Last year the price of potato seed rose to as high as Rs. 12 per maund. Methods of storage in sand are being demonstrated, as this has been found effective, and the department is running a small potato store this year to serve as an object lesson and to ascertain financial results. One or two growers have stored potatoes successfully in the manner demonstrated. Trials in the direct introduction of potato seed from the hills, where this pest at is present not prevalent, have not been successful; partly owing to expense of carriage and delay on railways (which resulted in a lot of seed being spoilt) and partly on account of the later ripening and smaller yield of the hill variety. Storage under conditions which will reduce damage by the moth to a minimum seems the only practical measure and every effort will be made to encourage it. At present seed can be obtained with difficulty from villages where the moth has not been introduced, but this source of supply may fail at any time.

Very great damage is done to the rice in the submontane districts by the rice bug. The establishment of the new farm at Nawabganj has enabled some attention to be paid to this crop and demonstrations of bagging this pest were given. Operations must, however, be carried out over a wider area with the co-operation of larger numbers of cultivators to have any definite results.

Well-boring.

44. The number of borers employed, viz. 60, was somewhat smaller than in previous years; as it is difficult to obtain men on the wages offered. There was a keen demand for their services; and it was necessary to restrict their employment to purely agricultural work, though borers were lent to test the water supply for the proposed water schemes for the Muttra and Fyzabad Municipalities. In all some 1,004 existing wells were bored, in which the percentage of successes was 68 per cent., as compared with 932 in the previous year; and 261 test borings were made as compared with 250. Looking to the smaller number of men employed, the results are not unsatisfactory; but the usual difficulties in procuring labour, especially about harvest time, were experienced, and many of the diaries showed that the borers remained idle a long time in consequence.

45. In touring through some of the districts in which operations were being carried on, I found that complaints of delay and inefficiency were in a large measure due to the unsuitability of the plant and lack of expert supervision. The derricks now issued are far too heavy for the purpose, and so much difficulty is experienced in transporting and putting them together that the borers often prefer to improvise wooden makeshifts. Again, operations were undertaken in wells in which there is little probability of success with existing methods. A few failures mean an empty programme in the neighbourhood. When an Agricultural

engineer is appointed one of his first duties should be to introduce a lighter and more portable plant. Where the improvement of the well obviously presents considerable engineering difficulties operations should not be begun without expert advice. The bulk of the failures occur in percolation areas and it may be necessary to restrict work in these areas.

One of the borers was trained in sinking convoluted tube-wells, but in the absence of an Agricultural engineer no serious experiments were undertaken with this form of well. They may prove of considerable utility in percolation areas, where no clay foundation is met with, for which it has been recognized that a suitable form of well is required.

CHAPTER IV-B.

Associations, Shows, and Demonstrations.

Co-operative credit societies.

46. The department has always kept in view the desirability of entering into closer relations with the co-operative credit societies; and the question has come prominently to the front, owing to the necessity of finding some private agency for seed-growing and distribution. The establishment of seed farms managed and owned by private individuals is rarely possible in these provinces on account of the small size of the holdings. The utilization of the co-operative societies, the members of which are generally found to be very keen on agricultural improvement, naturally suggested itself. The arrangement aimed at is that demonstrations should be first made on the holdings of members of the society; the crop should be then sown by selected cultivators; the seed purchased by the society at harvest time and resold at sowing time. In this way the distribution of the seed over a wide area is ensured. The experience of the seed dépôts has shown this is a profitable business, involving hardly any risk, and should be advantageous alike to the society and its members. The society should also be able to keep bulls issued from the department farms. The department could assist in many ways by lending implements, the services of their agricultural inspectors, borers, and well sinkers, and in helping the societies to market their produce. In some instances the desired relations have been entered into and are working satisfactorily. The Gauria Kalan bank in the Unao district is now growing a variety of crops recommended by the Deputy Director and is making its own arrangements for supplying pure seed. The bank also ran a very successful agricultural show in January with no official assistance, except from the department. The Deputy Director also made arrangements with a Cawnpore firm for taking their produce in bulk and thereby secured them better prices. The Sandila bank is erecting a store house to follow on the same line; and several other banks took considerable quantities of seed and stored implements for the use of their members. Mr. Burt has now got in close touch with the principal societies of his circle and is meeting with the most ready support from the co-operators. There is, however, one practical obstacle to the development of closer relations. Few of the societies have the capital to embark on what is to some extent a trading venture. The arrangements proposed necessitate the erection of a store house to store seed and implements, and some additional clerical staff to keep the accounts, as well as ready money to buy in seed. Government has accordingly sanctioned the construction of a certain number of store houses and the purchase of seed in bulk by the department. When the system is in full working order it will be handed over to the management of the societies. Such a scheme will safeguard them against financial loss. Where a seed dépôt is in existence it will be handed over as a going concern to the society. The department is receiving the most cordial assistance from Mr. Chatterjee, the Registrar, Co-operative Credit Societies, who assures me that any measure to ensure direct relations with the Agriculture department will be most popular, as he rarely meets the members of a bank without being questioned as to the possibility of obtaining the department's seeds and implements.

Agricultural associations.

47. Agricultural associations are becoming sharply differentiated from co-operative societies as associations of zamindars. So long as they are composed of men actually cultivating their own land or keenly interested in the working of their estates,

they are likely to do good work. An instance of a successful association is the Mainpuri, the members of which hold regular meetings, which are attended by a representative of the department and held an exhibition which produced a number of excellent exhibits. A demonstration farm in connection with this association is being opened. The question of forming a similar association in Etawah, where there are a number of cultivating zamindars who are showing interest in the work of the department, is under consideration.

Agricultural shows.

48. The grant made by Government for prizes for agricultural and industrial objects has proved a stimulus to the exhibitions of the provinces. A number of successful shows were held, over which a great deal of trouble must have been taken and which reflect great credit on the local management. New exhibitions were started during the year in the Saharanpur, Bulandshahr, Bahraich, and Bara Banki districts. Few of these exhibitions are entirely agricultural; but at all there were agricultural sections in which produce, machinery, implements, &c., were exhibited. The latter as usual drew most attention and a considerable number of sales were effected. The firms recognised by the department added to the attractions of the shows by their exhibits. It is intended in future to arrange to supply exhibits of pumping machinery, about which a number of inquiries are being made. Agricultural shows afford a useful opportunity of meeting a large number of cultivators and exhibiting machinery and implements; but the satisfactory demonstration of improved crops is difficult and an attempt is being made to get over this, where feasible, by demonstration plots near the show ground.

Cattle shows.

49. Two shows were held in the Banda district. Both must be described as failures, as there was a falling-off in both the number and quality of animals exhibited. It is recognised that though these shows are useful as a market, they do little or nothing to improve the breed of cattle in the neighbourhood. The money spent on them could be more usefully devoted to prizes for young stock bred from bulls issued by the Civil Veterinary department.

Private farms.

50. The largest and best managed of these is the Jumna Mission Farm at Allahabad, which, when fully developed and provided with means of irrigation, should prove of great utility to the cultivators of the neighbourhood.

The Raja of Jagammanpur in the Jalaun district opened a state farm, principally for cotton-growing. The department has assisted with seed; and the Superintendent of the Orai experimental farm visits the state and advises on the management of the farm. Training is given at the Orai farm in the use of improved implements. Two new farms have been opened in Oudh; one by Raja Partab Bahadur Singh, C.I.E., and another by Thakur Raghunath Singh. The object of these gentlemen is primarily to improve the agricultural conditions of their estates.

Demonstrations.

51. The demonstration work of the department is carried on at (1) demonstration farms cultivated by the department, (2) small plots lent by or leased from landlords, (3) holdings of cultivators who themselves grow the crops under the directions of officers of the department. The first mentioned are about 20 to 25 acres in extent and are situated in districts where there is no agricultural station, and serve as seed farms and centres for work in the district. Moreover, they enable the officers of the department to become acquainted with the conditions and needs of the districts: looking to the enormous size of the circles some such means of extending operations are very necessary. These farms have been increased by four during the year, which practically means the opening of work in four new districts. It is hoped in course of time to have one such demonstration farm in each of the districts throughout the cotton tract. The smaller areas are for work in estates or villages and are employed mainly to demonstrate particular crops. Where the cultivators have been in touch with the officers of the department they can generally be trusted to give any new crop a fair trial. But in opening work in new localities, it is often preferable for the department to undertake the cultivation of the crop recommended. Sometimes *sir* land is offered by zamindars to

demonstrate new varieties. In this direction the co-operative societies are proving most useful. Once a paying crop has been introduced to a cultivator and his confidence is won, he is most willing to do his utmost to make any other crop entrusted to him a success. The members of the societies over which the influence of the department has extended are found to be ready to carry out implicitly the directions given them.

The objects of demonstration were varieties of crops, implements, and improved methods of cultivation. Some demonstrations have been given in the eradication of deep-rooted weed, such as *kans*, *baisurai*, and *rarhi*. Though this can be effected by deep ploughing at the appropriate season, the work is beyond the capacity of the oxen at the cultivators' disposal and the area cleaned is small. A steam tractor was accordingly hired to give demonstrations of the eradication of the *baisurai* weed which is spreading seriously in some of the western districts, preparatory to the purchase of similar plant by the department.

In connection with these demonstration farms, the question arises as to the staff most suitable to work them. It is doubtful whether it is necessary to employ overseers to carry on the work at these farms which can be equally well done and at a lower cost by fieldmen. At present the Deputy Directors and the Economic Botanist are employing these men with satisfactory results. They have the advantage of being better able to control labour and of accommodating themselves more readily to live in villages. The expansion of the department work will inevitably call for the employment of some cheaper material than officers trained at the college and this will probably lead to the larger employment of the fieldmen class in the smaller demonstration farms.

Receipts.

52. The total receipts of the department credited in the treasuries for the year ending March last amounted to Rs. 39,216. Under the orders of Government the receipts from the seed and demonstration farms will in future be shown separately and compared with expenditure. This procedure could not be followed in the present instance, as some of these farms only came into existence during the year and their crops were not sold at the end of the financial year to which these accounts relate.

For instance at the Kalai farm, which came under regular cultivation last rabi, there were some 80 acres under wheat, the whole of which was sold for seed purposes after the end of March and the receipts will be credited to the accounts of the present year. The seed farm at Cawnpore showed receipts of Rs. 3,416 during its first year of working.

CHAPTER V.

Agricultural Engineering.

53. In the absence of an Agricultural Engineer very little progress has been made in this branch of the department's work. With ample sources of water supply in wells, *jheels*, and rivers, the provinces offer great possibilities of development in power pumping. The rise in price of cattle and labour has forced attention to the subject and numerous inquiries regarding oil engines and pumping plant testified to the interest taken in it. But without an engineer the department can neither undertake to give advice nor what is more important, to train mechanics and assist in keeping the plant in working order. As previously noted, the want of an engineer with mechanical training and knowledge of well-engineering is severely felt in conducting the boring operations of the department and in running the workshop at Cawnpore for the repair of plant.

54. Mr. Burt gave such assistance as was in his power with the departmental staff, and Mr. Vick, the Superintendent, Roorkee Workshops, has assisted the department with technical advice and was occasionally able to pay visits to correspondents desiring to purchase machinery. One installation was put up in the Mainpuri district for a zamindar (including oil engine pump and flour mill) and a somewhat similar installation is being completed at Farrukhabad. The installation of a 40-H. P. oil engine with 12 cotton gins and three flour mills was completed early in the year and ginned out the whole of the American cotton grown in that part of the district. Several oil engines have been adjusted and repaired by the departmental staff.

CHAPTER VI.

PUBLICATIONS AND SUPPLY OF INFORMATION.

Bulletins.

55. No English bulletins were published during the year under report. A note on rinderpest is in press.

Pamphlets.

56. The issue of pamphlets in vernacular dealing with agricultural subjects is becoming popular and most of the important pamphlets issued in previous years had to be reprinted for distribution. The following vernacular pamphlets were issued during the year :—

(1) Maize cultivation with *nai*, i.e. advantage of deep sowing.

(2) How to get reliable machine-ginned cotton seed.

(3) Use of Poudrette as a manure for Bundelkhand soils.

57. A number of articles were contributed by the Deputy Director of Agriculture, Western Circle, to the Aligarh District Gazette which has a wide circulation and is a good medium for bringing the work of the department to general notice.

Scientific papers.

58. The following publications were issued :—

Botanical Section—

(1) Memoirs of the department of Agriculture in India—Botanical Series, Volume V, No. 2.

(2) Wheat experiments on the Botanical area Cawnpore and their bearing on wheat cultivation in the United Provinces by Mr. H. M. Leake, Economic Botanist to Government, United Provinces, and Ram Parshad, Assistant to the Economic Botanist.

(3) The problem of the improvement of the indigenous cottons of the United Provinces by Mr. H. M. Leake, Economic Botanist to Government, United Provinces, and Dr. A. E. Parr, Deputy Director of Agriculture, Western Circle.

Chemical Section—

(1) Phytin and Phytic Acid, published in the Proceedings of the Chemical Society, London.

(2) The World's Sugar Industry (a review), published in Indian Journal of Agriculture.

Periodicals.

59. Dr. Parr contributed the following articles to the Agricultural Journal of India :—

(1) Root development of cereals.

(2) Drainage and soil aeration.

The Vernacular journal.

60. This journal known as the Risala-Mufid-ul-Mazarin was issued regularly throughout the year under report. Other vernacular journals reproduce some of the important articles. Mr. Sharma is taking a good deal of trouble about the editing of this journal, and is paying special attention to making the information more strictly practical.

Correspondence.

61. The amount of correspondence received increased considerably at all the circles and replying to the letters received occupies a good deal of the circle officer's time. Among the regular correspondents of the department must be included those gentlemen who very kindly undertake the duty of sending in reports on the area and outturn of the crops for the provincial crop estimates. They were very prompt in the submission of their reports and gave full and valuable information. I take this opportunity of thanking them for the assistance they have rendered.

CHAPTER VII.

MISCELLANEOUS.

Conclusion.

62. As noted last year, the great need of the department is an increase in the superior staff. The circles as at present constituted are unworkable. The provinces have a normal cultivated area of some 35 million acres, and grow a great variety of crops, most of

which in one way or another require attention. The appointment of a third Deputy Director and the creation of a new circle is very necessary for the proper development of the department.

I have the honour to be,

SIR,

Your most obedient servant,

H. R. C. HAILEY,

Director.

APPENDIX.

New planting was done on 106 miles of provincial roads and 230 miles of local roads, as compared, respectively, with 100 and 186 miles provided for in the working plans. Out of 230 miles planted on local roads 48 miles were planted by private individuals in Rae Bareli (17 miles), Bulandshahr (11 miles), Bahraich (6 miles), and seven other districts.

Working plans.—The majority of districts have carried out their working plans but there have been divergencies on provincial roads in 4 districts and on local roads in 16 districts. Explanations of divergencies in the case of local roads have been received from all districts except one (Unao). In seven districts trees were planted in excess of the plan generally to make up for the deficiency of the last year's programmes, in four districts funds were diverted to filling up gaps ; in two districts the full amount of planting could not be done for want of trees ; in one district planting was suspended owing to the widening of the roadway and in another to the transfer of roads from District Board agency to the Public Works department. Unsuitable trees were not planted to an appreciable extent in any district except Muttra.

Extension of avenues.—The reports received during the year show that 36 miles of "paper avenues" have been removed from the list of avenues, while 149 miles of recent planting have been added as "established."

Training class for supervisors.—The training class for supervisors opened as usual in April last at the Government Horticultural Gardens, Lucknow, and is being attended by 11 students sent to it by district boards.

Financial results.—The receipts and expenditure on provincial roads rose from Rs. 25,180 and Rs. 71,976 to Rs. 35,140 and Rs. 79,730, respectively. The net cost to Government was Rs. 44,590 as compared with Rs. 46,796 in the preceding year. The increase in expenditure is mainly due to the enhanced cost of (fencing) protection. The expenditure on local roads was Rs. 1,10,381 or Rs. 6,639 more than in the preceding year. The receipts amounted to Rs. 88,152 as compared with Rs. 69,288 in the preceding year. The increase in receipts is chiefly due to enhanced income from sale of fruits.

REPORT

ON THE

Administration of the Department of Agriculture

OF THE

UNITED PROVINCES OF AGRA AND OUDH

FOR THE YEAR ENDING 30th JUNE 1914.

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Report on the Administration of the Department of Agriculture of the United Provinces, for the year ending 30th June 1914.

No. 82 / V—849 A. OF 1914.

FROM

THE HON'BLE MR. H. R. C. HAILEY, I.C.S.,

DIRECTOR OF LAND RECORDS AND AGRICULTURE,

UNITED PROVINCES,

To

THE CHIEF SECRETARY TO GOVERNMENT,

UNITED PROVINCES, REVENUE DEPARTMENT.

Dated Lucknow, the 22nd of October 1914.

SIR,

Errata to the Annual Report on the Administration of the Department of Agriculture, United Provinces, for the year ending 30th June 1914.

Page 7A, lines 5 to 7, *omit* paragraph from "A statement.....financial year."

Page 9A, line 20, *for* "and" *read* "at."

Page 14A, line 5, *for* "salready" *read* "already."

Page 14A, line 11, *for* "two and a half years years" *read* "two and a half years."

CHAPTER I.

ADMINISTRATION.

Officers of the staff.

3. I remained in charge of the department throughout the year. Mr. H. M. Leake, Economic Botanist, returned from ten months' combined leave on 14th February 1914 and remained in charge of the office for the rest of the year, officiating for one month for Mr. G. Clarke, Agricultural Chemist, when the latter was on leave. Mr. B. C. Burt held charge of the Central Circle during the whole year. He also officiated as Director of Industries in addition to his ordinary duties. Dr. A. E. Parr returned from three months' privilege leave on 20th September 1913 and took charge of the Western Circle from Rai Sahib Babu Ganga Pershad, the senior member of the Subordinate Agricultural Service of the circle. Mr. A. W. Fremantle was Principal of the Agricultural College, Cawnpore, throughout the year. Mr. G. Clarke was in charge of his office for the whole year with the exception of one month he was on privilege leave. Mr. L. C. Sharma, Assistant Director, held charge of the Eastern Circle throughout the year. Mr. W. Wilson officiated for the Economic Botanist till his return from leave after which he reverted to his post of Assistant to the Economic Botanist which he held for the remaining period of the year.

4. Mr. F. H. Vick was appointed to the post of the Agricultural Engineer on 16th October 1913.

5. Khan Bahadur Mir Saiyid Husain, my Personal Assistant, held charge of his office till 21st May 1914 when he went on privilege leave for two months and M. Abdul Aziz, II, Probationary Deputy Collector acted for him.

6. M. Akhtar Mohammad Khan, Deputy Collector attached to the department for the investigation of the commercial prospect of sericulture in these provinces, remained in charge of his duties throughout the year.

7. The services of Mr. W. Hulme were placed by the Government of India at the disposal of this Government as Sugar Engineer for three seasons which he completed on 11th April 1914 and went back to England. The Local Government have, however, recommended an extension of his term of appointment for two more seasons.

Development.

8. The main lines of work have followed those set out in last year's report. Research and experimental work have been continuously carried on at the various agricultural stations; but the more immediate necessity is the development of organizations through which the results gained by this work in the past may be introduced into the agriculture of the provinces, and through which the officers of the department may keep in touch with the agricultural community and exercise the influence which is essential to progress. To a large extent this consists in developing relations with local bodies, such as district boards, co-operative societies and influential landlords, who are willing to further the work of the department in such matters as demonstration, the multiplication and distribution of improved varieties of seed, sale of implements, provision of water supply, &c. Without the assistance of such agencies, the small staff of the department can reach only the fringe of the population, principally those living immediately round the farms. With such assistance, when organized in the manner best fitted to fulfil the purposes required—which must be a matter of time—the department can come into close relations with cultivators in the mass, and gradually assert its influence for the betterment of agriculture. Before, however, what I have termed the local agencies, can render effective assistance they must be provided with the necessary machinery: they must arrange for the acquisition or control of land for demonstration and seed production, godowns for storing seed and implements, and some sort of staff for conducting operations. For carrying out these arrangements they need the advice and guidance of the department. It is this side of the work of the department which has come into increasing prominence during the year, and in which most development has taken place.

9. For the above purpose it is desirable, if not absolutely necessary, that there should be centres of work in each district. Cultivators must be given an opportunity of seeing improved methods in actual working and improved types of crops in the field: there must be some officers of the department within reach to whom the co-operative societies can look for advice and assistance. There must also be centres for seed distribution, storing of implements, &c. New district farms have been opened during the year in the Bulandshahr and Saharanpur districts; while as will be seen from appendix III a number of small farms and plots have been opened in the eastern circle in co-operation with landlords, or the local boards. Some of these such as the Bulandshahr and Ballia farms are partly supported by the district boards. At Mainpuri the Agricultural Association have started a farm which is being managed by the department. Seed is supplied from these farms to the co-operative societies or landlords, working in conjunction with the department, who undertake to multiply it and distribute among the members of the society or their tenants. In the Eastern circle a number of private farms have been opened for this purpose. So far as possible land for the district farms is being taken up near head quarters, so that they may be readily accessible to the public; and visited by co-operators at their meetings. In certain instances it has been arranged that these meetings shall be held at the farms.

10. Some of the district boards are now beginning to take an interest in agricultural improvement and to show it in a practical form. In addition to those mentioned above who are helping to support a district farm, similar offers have been received from the Sitapur and Moradabad boards. The smallness of the staff has hitherto made it impossible to take advantage of these offers; but arrangements are being made to train men to place in charge. The cordial assistance

of these boards is very welcome. Apart from financial considerations, some of the members of these boards are themselves landlords or managers of co-operative societies; and their association with the department is particularly valuable. A certain number of boards already keep bulls for the use of the cultivators of the district; and these farms will be suitable places for locating them. So far as possible the department is trying to meet the generally expressed wish to demonstrate power pumping at these farms. Applications continue to be received from landlords to provide trained man to run demonstration farms they are anxious to open. For the most part it is quite impossible to comply with such requests; but, with the activity now shown by district boards they form good indications of the growing interest taken in agricultural improvement.

11. Another noticeable marked development of the year has been the extended use of mechanical power for water-lifting following on the appointment of the agricultural engineer. It has been most marked in the western districts, particularly in the Bulandshahr district, where the greatest assistance has been received from Chaudhri Amar Singh, who has started a school to instruct drivers. A detailed account of the operations will be found in the report of the Western circle, appendix I. A great stimulus has undoubtedly been given to the substitution of mechanical power by the rising price of cattle, and, provided the area controlled is sufficiently large, the experience of those who have tried power pumping is that it is much more economical. Though still in its trial stage in these provinces, there are obvious wide possibilities for mechanical power in the better utilization of our numerous wells and small streams. Almost equally important is the use to which the engines are being put in the off seasons, e.g. ginning *kapas*, grinding wheat, crushing oil, seeds, &c.; and it is hoped to introduce a suitable plant for cane crushing

CHAPTER II.

AGRICULTURAL EDUCATION.

Agricultural college.

12. During the year under review a separation was effected of the kanungo students from the Agricultural college; a school being established for candidates for kanungoship. From the point of view of agricultural education, a combined training for both agricultural and kanungo students presented obvious disadvantages: the two classes of men were designed to follow different careers and required technical training of a different nature and other standards of knowledge. One branch of training must inevitably assume prominence over the other. Owing to the largely disproportionate number of kanungo students, the college was in fact becoming subordinated to training candidates for the revenue staff. The system finally broke down of itself; the college was unable to turn out the required number of recruits for either the agricultural or revenue staff, and both services were seriously depleted. As the accommodation at the college was limited and the proportion of kanungo to agricultural students was about four to one, the removal of the former has left the college with small numbers. This was inevitable in view of the fact that the maximum number of agricultural students which could be received in any one year was ten. The sacrifice of numbers was, however, well worth undergoing to establish the institution as an agricultural college. It may be hoped that it is only a passing phase in the history of the college. Apart from its value to those wishing to devote themselves to agricultural pursuits, the college had solid advantages to offer as an avenue to the Agricultural department which should render it attractive.

13. One result of the former system is that the Agricultural department is seriously undermanned, and to carry on the work at all it has been necessary to admit men without the desired educational qualifications. Even after such admissions, there are 19 vacancies in the sanctioned grades, and the short numbers are severely felt in a small and expanding department. This has handicapped the circle officers and rendered it necessary to refuse assistance which, with full numbers, would have been cheerfully given. The whole question of reconstituting the course of training at the new college, with a view to increasing its usefulness and popularity, has been under the consideration of Government and opinions have been invited on the subject.

The class which it is hoped to attract and which is likely to benefit most from the teaching are the sons of zamindars or larger cultivating tenants; and special facilities in the way of scholarships have been offered to enable them to enter the college.

Other agricultural training.

14. The experiment was tried of admitting a certain number of village school teachers to one of the farms with a view to giving them some training in agriculture. The training given was of a purely practical character, in the hope that they may interest some of their students in the work of the department. No attempt has been made to train the teachers to give a course of nature study to their pupils.

Horticultural education.

15. The overseer class at Saharanpur is complete and two students have been admitted from other provinces. As our provincial requirements will shortly be fully satisfied, the school can only be kept on if students from other provinces enter. There were classes for *chaudhris* at both the Lucknow and Saharanpur gardens. The usual difficulty was experienced with this class, as the men do not understand that they are to be taught practical and not literary work. Those, however, who have passed on through the course readily obtained employment at good wages. The demand for gardeners is still in excess of the supply. At the Saharanpur gardens 83 applications were received, but only 13 trained men were available.

CHAPTER III.

RESEARCH AND EXPERIMENT.

Cotton.

16. The subjects under investigation by the Economic Botanist are shown in appendix IV. He was engaged mainly on the complex questions connected with ginning percentage, the results of which have been published. In the Western circle, Dr. A. E. Parr, had under trial several types of cotton received from the Economic Botanist with a view to comparing them with local and American types. Experimental work continued with *buri* cotton of which an early maturing type had been obtained by selection. This cotton is not quite fulfilling the promise it once gave, and it is doubtful whether it will be suitable to some of the conditions under which it is likely to be grown in these provinces. In the Central circle, experimental work was mainly directed towards improving by selection the ginning percentage of Cawnpore American and the production of a more uniform lint. Trials given in Bundelkhand to type 7—a pure strain selection of Mr. H. M. Leake's—go to show that the cotton is likely to prove very successful in that area. It is early maturing—a feature which is essential looking to the short growing period of the tract—hardy and has so far shown itself a heavy yielder. The staple is better than that of *deshi* and seems to meet the requirements of the mills which for ordinary work want something better than *deshi* but not so good as American. Satisfactory prices have been offered for it when produced in sufficient quantities. The type will be highly tried this year, but if satisfactory, will be put out on a large scale in the following season.

In the Eastern circle the growing period is longer than in the rest of the provinces. The efforts made to find a satisfactory substitute for the poor types ordinarily grown have not so far been successful.

Sugar.

17. As the work on sugar still remains largely of an experimental character, the subject may be dealt with in this chapter.

On the cultural side, the difficulties about the water supply at the Shahjahanpur research farm are being gradually overcome, and the work begun by Mr. G. Clarke, the Agricultural Chemist, at Partabgarh, is being carried on there under more favourable conditions. An account of this work is given in appendix V. The general results obtained at this and other farms go to show that with proper cultivation and watering the selected varieties of thick canes will give yields which compare not unfavourably with those obtained in other parts of India and other canes-growing countries. From a manufacturing point of view these canes are easier and cheaper to work, and have a higher sucrose content than the *deshi*. If, however, these canes are to receive the same treatment as *deshi* receives—that is, are given little or no manure and left to struggle through the hot weather with no watering or an entirely inadequate

supply—better results would probably be obtained by growing the best of the *deshi* varieties, which can survive such treatment. The cultivator himself is fully alive to the necessity of more intensive cultivation for his *paunda* or eating canes, from which yields of 30 to 35 tons per acre are commonly obtained, but it has not yet been made worth his while to bestow the same care and incur the same expense on canes to be used for sugar making.

It is here that the factory owner must come in and assist the cultivator. It is abundantly evident that it will pay both parties to put more money into the cultivation of the crop. The cultivator will obtain a heavier crop—at a higher cost it is true, but not proportionately to the heavier yield ; the manufacturer, paying the same price per weight of cane, will obtain a cane with a higher sucrose content and easier to work on account of the smaller amount of fibre. This is perhaps a matter for the future ; in the meantime a good deal can be done by selecting the best from among the many local varieties. Particular varieties have shown marked superiority in definite areas—such as the *saretha* in the Meerut division, *dhaur* or *dhaul* in parts of Rohilkhand, *reora* in the Benares division—and the extension of their cultivation is being encouraged.

18. On the mechanical side, possibly more can be done. The best use is not made of much of the cane that is grown. It must be clear to any one watching the cane crushing operations as commonly carried on in these provinces, that with the weak bullocks and limited time at the cultivator's disposal, the cane is often only lightly crushed and much sugar remains in the megass which is burnt. Further, to get through the work to be done, crushing is often begun before the canes are ripe ; with the result that the *gur* made is of poor quality. The cattle question is also adding to the existing difficulties ; big cattle, strong enough to work powerful mills, are now expensive and the cultivator has to be content with the animals he can afford which often can not work a three roller mill. The strain imposed on the cattle by the heavy labour of crushing is great, and agricultural operations suffer from their being withdrawn at a time when they are particularly required. It is often for the cultivator a choice between leaving his cane uncrushed, or his rabi fields unirrigated. It is therefore from every point of view imperative to endeavour to substitute some form of power crushing. The matter is summed up in a bulletin by Mr. G. Clarke on notes on cane crushing in the United Provinces which is worth quoted in extenso. "It will be pointed out that many of the canes of the United Provinces can yield a high proportion of their total sugar on crushing in powerful bullock mills, but at a cost in bullock power that is entirely beyond the reach of every day agricultural practice. A considerable impetus would be given to the extension of the area under cane if a suitable small power mill for crushing cane for *gur* manufacture could be introduced. It is not necessary to aim immediately at the high extraction and efficiency obtained in the large mills of factories equipped with modern plant ; or of countries where the sugar industry is highly organised. An extraction no higher than that given by the best type of bullock mill would be sufficient ; but it is essential to deal with the produce at a reasonable rate and at a reasonable cost and to relieve the cultivator of the strain resulting from the present system of crushing by bullock power."

19. An experimental plant was brought out from England last year and Mr. W. Hulme, the Sugar Engineer, will occupy himself during the coming season in attacking this problem. Many zamindars grow cane in their *sir* and some are quite prepared to make a trial of any suitable plant which can be introduced. A considerable number of inquiries have been received for a plant that can be worked by the oil engines originally procured for water lifting. If a start could be made in this way, it would be a short step for the small capitalists to undertake the crushing of the cane of the cultivators in their neighbourhood.

Wheat.

20. The experiments with wheat consisted largely of comparison of Pusa wheats among themselves and with the provincial wheats. Looking to the diverse conditions of the provinces it is unlikely that one type will be found suitable for every part ; but Pusa no. 12 has done remarkably well over a wide tract of country, including the western submontane districts bordering on the Punjab, and the eastern districts

of the Benares division. Where ample water supply is available, Muzaffarnagar wheat will probably hold its own; but, as few of our canals have an ample supply of water, it may prove profitable to substitute Pusa no. 12 in parts of the canal irrigated tracts. Outside these particular tracts and Bundelkhand, Pusa no. 12 is superior to any other. In Bundelkhand Pusa no. 4 has done best; in this tract, owing to the small supply in the canals and tanks it is not safe to count on more than one watering, and this type seems to thrive under conditions which would be disastrous to most other wheats. A selected durum wheat is being tried for the entirely unirrigated black soil tracts and is doing well. In the submontane tracts, where water conditions are different and the growing period longer, another Pusa wheat grown by Mr. H. M. Leake at the Kalai farm is being tried.

Other crops.

21. Other crops on which varietal experiments are being carried out, are juar, maize, potatoes, groundnuts and *sann* hemp. On rice less is being done, but in many parts of the rice growing areas, well-known and highly valued types have been long established. More work is being devoted to ascertaining the best methods of cultivation and ridding the crop of the pests by which it is attacked. *Sann* hemp is becoming a very popular crop in the eastern districts, but the fibre is badly reported on owing to faulty methods of retting and the admixture of mud. Demonstrations have been given of better methods and prizes offered at the exhibitions for clean fibre free from tangles. It is however largely a matter for the buyer who can do more by rejecting samples containing large quantities of mud. Some new fodder crops, such as Teff grass, have been tried with satisfactory results; but the land at the farms is too small for this class of work and they will be given a wider trial at the cattle farms and the sullage farm about to be opened at Lucknow.

Soyabean.

22. Soyabean seed was distributed in different parts of the hills; but the year was very unfavourable and the crop on the whole a poor one. That grown on the Jeolikote gardens showed on analysis a satisfactory oil content. As it is more appreciated for eating purposes, the American bean which was distributed should in time supersede the small black bean—known as *batwa*—grown in the hills.

Green manuring.

23. Green manuring was tried at several of the farms with mixed results, but the year was unfavourable owing to the drought. The value of hot weather ploughing is now established in most parts of the provinces; and its utility was clearly shown in conserving sufficient moisture for sowing the rabi without irrigation.

Threshers and bhusa makers.

24. There are now three combined threshers and bhusa makers working at the farms. It is found that over 100 maunds per day can be dealt with without difficulty. The cattle take readily enough to the bhusa made. They are essential on the farms to set the cattle free for agricultural operations and are of considerable service to the cultivators of the neighbourhood whose crops are threshed on contract. Such demonstrations are of value, in that they encourage the wider use of mechanical power in agriculture. A tractor plough for the eradication of the *baisurai* weed, which has become a serious pest in parts of the Doab, was ordered from England, but did not arrive in time for working. Experiments are being made with a motor plough in Bundelkhand for the eradication of *kans*.

Sericulture.

25. Efforts continue to be made to popularize eri silk culture; but, so far, it cannot be said with much success. Better prices are now being offered for the raw silk and the cultivation of the castor plant is extending; but the worms seem to require more care and attention in the climate of these provinces than the cultivator is prepared to give them. Unless the industry can also be established in the hills, the difficulty of procuring seed after each hot weather is likely to prove a serious obstacle. So far it has not been possible to produce raw silk on a commercial scale; but the system adopted this year of granting advances to cover preliminary expenses may induce a larger number of persons to take up silk worm rearing.

Sheep breeding.

26. Sheep breeding experiments have been carried on at some of the farms in conjunction with the Civil Veterinary department. The introduction of the merino strain has been found to have a very beneficial effect on both the quality and quantity of the fleeces. Samples

of the wool of the half breds have been submitted to wool experts and very favourably reported on. Though mortality was high among the imported rams, the half bred progeny seems to stand the climate satisfactorily and to be much less susceptible to disease.

CHAPTER IV.

ASSISTANCE TO THE PUBLIC.

Distribution of seed.

27. Seed distribution on a large scale of Aligarh white flowered cotton was continued in the Western circle. The advantages of this cotton, in its higher ginning percentage and better yield over *deshi*, are now generally recognised and its cultivation is rapidly extending. As the area expands the difficulties of keeping some control over the seed and maintaining purity grow greater. The policy originally followed was to allow cultivation to expand naturally from the farms to the exclusion of other types. Cultivation has now however outstepped these limits; and arrangements are being made with co-operative societies to distribute the seed among their members, and with landlords and others to gin the *kapas* and sell the seed to cultivators in the neighbourhood. With sufficient supply of seed it should replace other types within the given areas in which operations are undertaken.

28. In the Central circle about 500 acres were sown by cultivators in 1913 with Cawnpore American cotton. The average yield was 8 maunds of *kapas* per acre, which is above the yield of *deshi* cotton. The lint was purchased by the Elgin mills who had guaranteed a minimum price; and the total premium paid to the cultivators amounted to about Rs. 1-8-0 per maund. The lint was favourably reported on by the mills who have entered upon an agreement to take the bulk of the present year's crop. Some difficulty was experienced in ginning with roller mills and in grading which it is hoped to evercome this year. Seed for about 5,000 acres has been issued for the 1914 kharif. The whole of the seed is entirely controlled by the department and ginned in a private factory to prevent admixture.

For those parts of the circle for which canal water is not available, the seed of Aligarh white flower was distributed, and it is found to do particularly well in the cotton districts of Oudh. In Bundelkhand arrangements were made with the canal department for the introduction of the system of early sowing of cotton with canal water. The advantages of the system and the marked superiority of the crop so sown were generally acknowledged, and, as soon as the reservoirs of this area have been sufficiently enlarged to give a regular supply, it is likely to extend rapidly.

29. Large quantities of wheat seed were distributed from each circle, mainly through the co-operative societies. The wheats distributed were either Muzaffarnagar, Pusa nos. 8 and 12. In future the latter has been selected for issue over the greater part of the provinces. Arrangements have been made by the Imperial Economic Botanist for supplying a certain quantity from Behar; and this, together with such seed as was produced at the farms or bought in from selected cultivators, has already been sold for rabi sowings. Next year a much larger quantity will be supplied from Behar and some of the co-operative societies will have completed their arrangements for buying in seed for distribution. A consignment will then be placed on the European market to establish its value as compared with *deshi* wheat.

30. Seed of a number of other crops was distributed from the farms. In the Western circle of *saretha* cane, large quantities and in the Eastern circle of *reora* cane, were sold—these two varieties having been found most suitable for the tracts in question. In the Central circle, juar and early ripening arhar were most in request; and arrangements were made for importing juar seed on a large scale for the famine districts of Bundelkhand. Ground nuts are now well established; though the seed available is readily taken up for new sowings. There are 16 seed dépôts in the Eastern circle for the supply of pure seed managed by the department. Their financial success shows that they are appreciated by the cultivators.

Improved methods of cultivation.

31. These are demonstrated at the farms and practices, such as hot weather ploughing and deep sowing of maize, are spreading. But before any definite improvement is likely to show itself, the water supply must be secure and the adoption of better implements of

agriculture more general. Wherever the water supply is secure, the cultivators are turning their attention to better cultivation and the purchase of manures. Dr. Parr notes that as soon as a cheap supply of water is secure, cultivation becomes more intensive and to prevent impoverishment of the soil manures have to be sought for from outside sources.

Sale of implements.

32. These continue to be sold in considerable numbers at the farms and sub-centres, from which implements are also let on hire. The principal demand continues for ploughs, chain pumps and maize shellers.

Silos.

33. A demonstration of preserving fodder in a silo was given at the co-operative dairy, Benares, and a masonry silo is being constructed for the dairies at Lucknow. The pits were opened at a time when fodder was scarce and dear and the ensilage was readily bought up. These co-operative dairies in the future will make their own arrangements for storing fodder in this manner.

Well boring.

34. The year was a dry one throughout and there was an unprecedented demand for the services of the borers of the department. In all 1,642 existing wells were bored as against 1,004 in the previous year; and 418 test borings for new wells made as compared with 261. This is by far the largest amount of work done in a single year, and it is creditable to the staff whose numbers were only slightly increased to meet the extra demand. The percentage of success was about the same as in previous years, viz. 66 per cent., the failures being most numerous in the submontane districts and Bundelkhund, where the work presents unusual difficulties. In districts, such as Rae Bareli, Lucknow and Etah, where a lower water bearing stratum is met with at no great depth and wells can be improved at small cost, the demand for the services of our borers was very great and employment could readily have been found for a much larger number. A certain number of private firms have now taken up the work, especially in the western districts, and this is permitting of the reduction of the staff in these areas.

35. With the introduction of power pumping it is now possible to form some idea of the improvement effected by boring operations. In some of the wells in which a 4″ pipe was sunk, a continuous discharge of 12,000 gallons per hour has been obtained. At the Shahjahanpur farm where a 6″ pipe was sunk, with a pump working 10 to 12 hours per diem, the well gave a constant discharge of 16,000 gallons per hour. This well before boring gave only enough water for one *charsa*. It is now the equivalent of a twelve *charsa* well. We have therefore in these provinces inexhaustible supplies of under ground water, for the most part at no great depth from the surface, since it is rarely necessary to carry the boring lower than 100 feet. The immediate problem is the lifting of this water; and any comparison of the present price of bullocks and an oil engine must justify the conclusion that the latter are far cheaper.

36. In Bundelkhund which lies outside the alluvial tract, the problem of obtaining a satisfactory water supply is far more difficult. In parts of this tract water underlies rock; and in other parts it is not met with at less than 80 or 90 feet. In the former cases the boring tools employed are useless. As the water supply was running very short, additional blasting overseers, who had been trained in the use of dynamite, were employed to blast the rock. A sufficient supply of water was in this way usually obtained for drinking purposes.

CHAPTER V.

MISCELLANEOUS.

Receipts.

37. Total receipts for the year amounted to Rs. 66,264 as against Rs. 39,216 in the previous year. The above amount does not include proceeds from sale of rabi crop which had not been threshed at the time when accounts were made up. In some of the farms the kharif crop was poor owing to failure of the rains and the receipts abnormally small. The farms recently opened were not in working order, and will show receipts next year.

Co-operative Societies.

38. As will be clear from the foregoing paragraphs many of the co-operative societies are working closely with the Agricultural department. The early steps were necessarily slow, as relations with the department involved some change in the functions of these bodies; but the system of big central banks, financing and controlling the village banks, lends itself to undertaking the work of supply associations, and the feeling among co-operative bodies was against forming separate societies for agricultural work. Four of the larger central societies have opened seed stores and are undertaking in conjunction with the department to introduce selected varieties of seed among the members of the affiliated societies. Pure seed is in the first instance issued to the society which undertakes to issue to selected growers and multiply for general issue in the following year. It is intended to distribute the large supply of Pusa no. 12 wheat seed, which will shortly be available, through these societies. In the central circle, except in case of Cawnpore-American cotton seed which is being put out on a definite area, the co-operative societies take the bulk of seed of all kinds available. In return for the help so received, the Agricultural department places inspectors at the disposal of these societies to assist in demonstration, selection of seed, ginning, &c., and gives assistance in marketing produce. The subject of improving water supply on holdings of members is one that engages a good deal of attention of the society managers. Borers are lent to improve the capacity of the wells, and in two instances arrangements have been made to put down power pumping to supply water on a large scale. A number of inquiries on this subject has been received and as the possibilities of supplying water on a co-operative system are realised, installations are likely to increase in number. Some of the societies are also proposing to keep bulls, as soon as the cattle farms are in a position to supply them.

Private farms.

39. In the eastern circle the policy of encouraging the opening of private farms on large estates has been more widely pursued, and 40 of such farms have been opened during the year. The landlords grow seed to distribute among their tenants The system is well suited to districts where much of the land is held by large estates; but with our present staff it is difficult to exercise any proper supervision over these farms.

Fieldmen.

40. The shortage of trained officers and the demands for assistance from co-operative societies and landlords have necessitated a very considerable increase in the staff of fieldmen, who are now being formed into a graded service. The advantages of employing this class of men are numerous. In the first place they are considerably cheaper than diplomates; being agriculturists themselves they adapt themselves more readily to life in out of the way places and are often in closer sympathy with the cultivators than better educated men. The service will probably be considerably enlarged in the future.

Agricultural exhibitions.

41. Some twenty exhibitions were held in different parts of the provinces; most of them were very largely attended. Owing to the appointment of an Agricultural Engineer it was possible to give demonstrations of the working of oil engines for water lifting, flour grinding, oil crushing, ginning, &c. Some of the co-operative societies now hold their own exhibitions at which very good displays of agricultural produce were shown. It is generally found that these exhibitions afford opportunities for meeting large numbers of cultivators and that a keen and professional interest is shown in the exhibits. But the despatch of exhibits and arranging of the agricultural courts takes up too much of the time of the staff; and in future it will be necessary to confine attendance to a smaller number.

Agricultural engineering.

42. No systematic work in this branch could be begun until a whole time engineer was appointed. Mr. F. H. Vick took over charge of the post in October last. The appointment came at an opportune time; as the year was a dry one and Mr. F. H. Vick had in a short time more applications for assistance than he and his small staff could cope with. A detailed account of the work is given in appendix VII.

The main lines of work are the improvement of wells and the installation of mechanical means of water lifting; the utilization of the numerous small streams

of these provinces and experiments for the provision of a suitable form of well for the percolation areas in which spring wells cannot be constructed. There are great possibilities in each direction. Throughout the alluvial area there are inexhaustible supplies of water in the sub-soil comparatively near the surface, and it is now apparent that we can tap these supplies to a much larger extent than has been done in the past: while there are numerous small streams with a perennial flow of water which are at present almost unutilised. There are many parts of the provinces to which the canal system can never be extended and for protecting these areas we must look to the subsidiary sources of supply.

43. It is obvious however that there must be a complete departure from previous methods and that operations to be profitable must be carried on a much larger scale. It does not pay to put up a pumping installation for irrigating a few acres. Such installations are rather the work for estates or men with some capital. In order to examine the financial aspect, two wells are being sunk by the department in precarious areas from which water will be pumped and sold to the cultivators at rates agreed upon. Some of the court of wards estates are putting up installations by small streams from which water will be delivered to the adjoining villages. Water is at present drawn from these streams in baskets through a series of lifts ; and the rates offered by tenants for water delivered on their fields should make such undertakings profitable.

General.

44. As has been noted, a marked and growing interest in many branches of agricultural improvement is being shown, not only by the actual cultivators of the soil, but by those who as landlords or managers of co-opertive societies are in a position to influence or assist them. This of itself is a hopeful sign for future progress and will do much to facilitate the work of the officers of the department ; but, as with other early enthusiams, some misconception prevails as to the possibilities and limits of improvement in the present economic conditions of these provinces. It is sometimes urged that the measures recommended by the department are beyond the reach of the mass of the cultivating community. It is not clearly understood that better methods of agriculture, though they will amply repay the outlay, involve a higher expenditure than the backward and primitive. Whoever wishes to adopt them must be prepared to put some money into them. Even a better and purer seed, the simplest and easiest means of increasing the outturn, must cost more than the sweepings of the banias shop often put into the ground. The department cannot work miracles, nor raise to affluence holders of minute areas, with neither cattle to properly work the land, nor sound seed to sow. Inevitably the department tends more and more to work for and with the cultivating zamindar, larger tenant or members of societies, who can command the small amount of capital required to carry out its recommendations. The cost of production, particularly the price of cattle and labour, is increasing ; all the present tendencies are towards the elimination of the small and impoverished tenant, and, from the point of view of agricultural progress, there is nothing to be gained by trying to bolster him up. This is an economic change which will only slowly make itself felt. Meanwhile it is well to recognise that agriculture, like all other businesses, requires some capital ; and to improve and develop the business more capital has to be introduced. The department would be retarding rather than assisting development, if it measured its activities by the capacity of weaker and less progressive section of the agricultural community.

Agricultural publications.

45. The following English bulletins were issued by the department during the year under report :—

1. *Bulletin no.* 28.—Note on rinderpest by E. W. Oliver, Superintendent, Civil Veterinary department, United Provinces.
2. *Bulletin no.* 29.—The improvement of the milk supply in the towns of the United Provinces by H. R. C. Hailey, Director of department of Land Records and Agriculture, United Provinces.
3. *Bulletin no.* 30.—(Revised edition of Bulletin no. 4). Names of the field and market garden crops and of the principal fruit and timber trees of the United Provinces by the department of Land Records and Agriculture.

4. *Bulletin no.* 31.—Note on glanders by E. W. Oliver, Superintendent, Civil Veterinary department.

46. A number of vernacular pamphlets and scientific papers were issued during the year which are detailed in appendices II and V.

47. The vernacular journal, the Mufidul-mazarin, edited by Mr. L. C. Sharma, was issued throughout the year and its circulation is steadily increasing.

The vernacular journal.

I have the honour to be,

SIR,

Your most obedient servant,

H. R. C. HAILEY,

Director.

APPENDICES.

APPENDIX I.

Report on the administration of the Western circle of the department of Agriculture, United Provinces, for 1913-14 *by* DR. A. E. PARR, B.SC., PH.D., M.A. *and* M.S. in *Agriculture, Deputy Director of Agriculture.*

The western circle was in charge of Rai Ganga Prasad Sahib during my absence on leave from June 19th, 1913, to September 29th, 1913. I held charge of the circle for the rest of the year.

This circle has now agricultural stations in the following districts :—

(1) Aligarh.
(2) Bareilly.
(3) Agra.
(4) Muttra.
(5) Bulandshahr.

Land is also being acquired for a station in the Saharanpur district. Aligarh is the Head quarters of the circle.

The farm in Bareilly which was opened in 1912 is a general Experimental Farm for the Rohilkhand tract.

The other three farms are at present being used chiefly as "Seed Farms."

District work.

Cotton.—There was a very large demand for white flowered cotton seed. A total of 180,000 pounds was sold from the Farms situated at Aligarh, Agra and Muttra. The area under this cotton is increasing very rapidly and it is estimated that this year about 70,000 acres of this type are being grown. Last year acclimatized Buri cotton was grown on a small area by a few cultivators for trial. It yielded extremely well and all the seed available was quickly indented for this year. As a result about 200 acres are being grown with Buri cotton this year.

Sugarcanes.—Saretha sugarcane was in great demand, 127,235 canes were supplied. More could have been sold had it been obtainable. Owing to the extremely bad season a large area of cane which had been set aside for seed yielded very low and all indents could not be supplied. Small quantities of thick canes were also supplied.

Wheat.—Two varieties of wheat are now being distributed in considerable quantities, viz. Muzaffarnagar and Pusa No. 12. Muzaffarnagar does well where irrigation is plentiful. In drier tracts Pusa No. 12 is superior.

Groundnuts.—Big Japanese groundnuts are now well established and little need be said of them.

Improved method of cultivation.

Deep sowing of maize as detailed in previous reports is becoming very common. The dry season gave a great impetus to this method of sowing.

The most remarkable feature of the year in this circle has been the great demand for oil engines for pumping purposes in the Bulandshahr district. This district has a large area irrigated from wells capable of giving a discharge of from 8,000 to 20,000 gallons per hour. The water in the wells is from 20 to 30 feet below the surface of the ground. Experiments have shown that an oil engine and a centrifugal pump can lift the water from these wells much cheaper than bullocks can do it. A good deal of experimental work has been done this year in working out a suitable plant and satisfactory conclusions have been arrived at. The installation which is now being recommended is one of the following depending upon the capacity of the well and the depth of the water from the surface.

7	B. H. P. Turner oil engine	and	4″	centrifugal pump.
7	ditto	ditto	3″	ditto.
4½	ditto	ditto	3″	ditto.

A number of engines have already been installed and a large number of orders have been received. These orders are being complied with as quickly as the engines come out from England. It is expected that very shortly there will be 50 engines working in the Bulandshahr district. Other districts are also showing some interest in the matter. A great deal of the work is being taken off the department's hands by Chaudhri Amar Singh, Rais and Honorary Magistrate. He is taking great interest in the matter and is proving of great assistance. Under his supervision a school has been started to teach ordinary villagers to drive the engines. It is hoped also eventually to have a workshop in connection with the school in which simple repairs will be taught. These pumping installations open up enormous possibilities of improvement. A cheap water supply being assured the agriculture is becoming very intensive. To prevent impoverishment of the soil more manure will have to be applied to the land and outside sources of manure supply will have to be drawn upon as the villages themselves are quite unable to supply the necessary quantity. I expect that these pumping plants and their owners will be of primary importance to seed distribution work in this circle particularly as regards the introduction of new varieties of cotton. So far because of the difficulties attending ginning a great deal of cotton seed has passed through the hands of the Agricultural department each year, many men refusing to make their own arrangements for seed for the following year. Several of these oil engines will have one or two cotton gins attached and each owner will constitute himself a supplier of good seed. Similarly as regards other seed as wheat, sugarcane, &c., an assured water supply will make these ideal centres for growing and distributing good varieties.

Co-operative Credit Societies are now beginning to render considerable assistance to the Agricultural department. In the Bulandshahr district societies are making their own arrangements for the multiplication and distribution of improved varieties of seed originally supplied by the Agricultural department.

They are also arranging to assist their members in putting up pumping installation. Some of the Bareilly societies are also showing considerable interest in the work on the Farm there. The Farm Superintendent has got in close touch with them and they now hold their meetings at the Farm. The Moradabad Societies are also doing good work.

Agricultural shows.

The following agricultural Shows were attended :—

(1) Aligarh,
(2) Bulandshahr,
(3) Muzaffarnagar,
(4) Meerut,
(5) Saharanpur,
(6) Budaun, and
(7) Karanbas.

The exhibits of the Agricultural department are an important feature of these shows. Special efforts were made this year at the Aligarh show. A large compound was set aside for the purposes and the result was a great success. The funds at present at our disposal do not permit of an equal display at shows some distance from head quarters.

Experimental work on the farm.

At Aligarh cotton, wheat, sugarcane, maize and groundnuts are the chief crops under investigation. Several varieties of cotton received from the Economic Botanist, United Provinces, are under trial. Some of them seem very promising. These are being tried in comparison with local cottons and some American types. Selected Buri cotton is still under trial. The present crop, like all other varieties of American grown on this farm, has suffered very considerably from an attack of aphis. It seems now that Buri will only yield satisfactory results where the land is in really good condition. This year where the land was good and well manured the crop suffered very little from the aphis attack, whereas where the land was not in good condition much damage was done. Several varieties of wheat are being tried on the farm. So far Muzaffarnagar and Pusa 12 have given the best results. Some recently received from the Economic Botanist, United Provinces, are very promising. A large number of varieties of groundnuts and sugarcane are being tested. So far Big Japanese groundnuts and Saretha sugarcane have proved superior. A large number of thick canes have been tried for *gur* production, but it seems very unlikely that these will be able to compete with the thin canes in this tract where the rainfall is small and the artificial water supply intermittent. Deep sowing of maize has consistently proved its superiority to the ordinary method of sowing.

Bareilly farm.

The chief experiments are :—

(1) Comparisons of the various varieties of thick and thin sugarcanes with the eventual intention of distributing the best.
(2) Trials of various varieties of wheat, rice, cotton, arhar, groundnuts, gram, soybeans and maize.
(3) Trials of various methods of growing sugarcane.

So far experiments have shown that the following varieties can be recommended :—

(1) Striped Mauritius cane for chewing purposes.
(2) Pusa 12 wheat and Muzaffarnagar.
(3) Early ripening arhar.

The farms at Agra and Muttra have so far been used for growing Aligarh white flowered cotton, wheat and groundnuts for distribution. The Bulandshahr farm was opened in April this year and is now growing its first crops.

A. E. PARR,
Deputy Director of Agriculture.

APPENDIX II.

Report on the administration of the Central Circle of the Department of the *Agriculture, United Provinces, by* MR. B. C. BURT, B.SC., *Deputy Director of Agriculture.*

Staff.—I was in charge of the circle throughout the year under report and also officiated as Director of Industries in addition to my ordinary duties.

Munshi Abdul Qaiyum, farm Superintendent, Cawnpore, has been transferred to the staff of the Agricultural College. One passed student of the college was added to the subordinate agricultural staff in this circle during the year and the staff of non-graduate fieldmen has been strengthened. The staff is however still very inadequate for the size of the circle.

The agricultural stations are situated in the *doab* (Cawnpore Experimental Station, Kalianpur Seed Farm, Etawah Demonstration Farm and Mainpuri Agricultural Association's Demonstration Farm), and in Bundelkhand (Orai and Atara Experimental Farms and Madhogarh Demonstration Farm); these tracts are so entirely distinct in every way that it will be convenient to treat them separately. The Department has no farm in the Oudh portion of the Central Circle, but our close relations with the Co-operative Societies in those districts have largely made up for this.

Doab *Cotton.*—The introduction of Cawnpore-American cotton was continued; the area in 1913, 500 acres, being entirely restricted by the available seed supply. Seed for about 5,000 acres has been issued for 1914 *kharif*. From 350 acres sown by cultivators in the Cawnpore district 2,800 maunds of *kapas* was bought in—an average of 8 maunds per acre, which is above the average yield of irrigated *desi* cotton in the Cawnpore district. At the experimental and seed farms this cotton yielded more *kapas* per acre than the Aligarh white flowered *desi* (which in turn yields more than the local *desi*) the difference at Kalianpur amounting to two maunds per acre. Similar results were obtained by cultivators who sowed this cotton at the proper time; if sown late the yield is materially reduced. The lint was all purchased by the Elgin Mills & Co., who had guaranteed a minimum price and an average price of Rs. 41 per 100 lb. maund was obtained as against Rs. 30 to Rs. 31 at the beginning of the season for *desi* which subsequently fell to Rs. 24. A total premium of Re. 1-14-0 per local maund of *kapas* (102 lb.) was paid to cultivators; this would have been higher but for the fact that much of the *kapas* was brought in comparatively damp so losing weight on drying and also contained a considerable proportion of stained cotton which had to be removed before ginning. In the case of clean and dry lots the premium paid amounted to Rs. 2-2-0. Had the later prices for American and *desi* cottons obtained during the picking season the premium would have been much higher. In the opinion of local cultivators this cotton was worth fully Rs. 15 per acre more than *desi* last year and in good fields still more. This result in an exceptionally dry year is of considerable importance and I wish to express my appreciation of the co-operation of the local-officers of the Irrigation department in this connection.

For those parts of the tracts where canal irrigation is not available the Aligarh white flowered variety of *desi* was again issued and did uniformly well. This selected *desi* cotton was however chiefly distributed in the Unao and Hardoi districts where cotton is entirely dependent on the rains and where a hardy cotton which will stand a good deal of dry weather, as well as being suited to comparatively late sowings is needed. Seed for about 2,000 acres was issued in 1913 year and seed for about 4,000 acres has been issued this year in addition to which there is known to be a large area sown with seed retained by cultivators and village dealers from last year's crop. Owing to the absence of ginning facilities in this district and to the falling price of country cotton, it was not possible to pay more than eight annas per maund *premium* for *kapas* of this variety, but it is growing in popularity on account of its yield.

At the Cawnpore Farm experiments in the improvement of the Cawnpore-American cotton by selection are being continued the object being to improve the ginning percentage and to produce a more uniform lint. At the Cawnpore Seed Farm a stock of pure seed of the above varieties has been maintained for distribution.

Wheat.—Experiments with Pusa wheats at the Cawnpore Farm were continued and also at Kalianpur. Pusa nos. 12 and 8 were again found to be the best for this locality and Pusa 12 was the better both as regards yield and quality. These varieties were also tried at the Etawah Farm with similar results and extensive district trials in Cawnpore, Etawah, Farrukhabad, Unao, Sitapur and Hardoi all resulted in favour of Pusa 12, although Pusa 8 also did extremely well in many cases. The former is therefore being introduced on a large scale, indents are already in excess of the available supply (about 1,400 maunds) and arrangements are now being made for a large supply for 1915 sowings. In conjunction with the Imperial Economic Botanist and the Economic Botanist to Government, United Provinces, arrangements are being made for placing a consignment of this wheat on the European market, in order to estalish its enhanced value. Apart from this however it is well suited to the *doab* and Oudh portions of this Circle and not only yields more than *desi* wheat but also requires less water.

The total issues of wheat seed from Cawnpore during the year amounted to 2,148 maunds of which the principal items were Pusa 8, 986 maunds, Pusa 12, 339 maunds, Pusa 106, 515 maunds and Muzaffarnagar 223 maunds. The last named variety was supplied to Mainpuri where this variety has always done well and Pusa 106 to Kheri Court of Wards where conditions differ from the rest of the Circle and where this variety has done consistently well.

It may be remarked here that it is not so easy to re-purchase wheat seed for re-distribution as it is to purchase *kapas* and that there is even greater need for seed grown by the Department. It is known that some wheat seed has been reserved by cultivators for future sowings but owing to famine conditions it was not possible to buy back any appreciable quantity for seed supply. This difficulty may be expected with most food grains.

Sugarcane.—At the Cawnpore Farm the Ashy Mauritius variety recommended by the Agricultural Chemist has done better than the local *paunda:* it requires less water and has been taken up by local cultivators. Experiments at the Atarra Farm have also shown that it is a good variety for sugar or *gur*-making. This variety is being multiplied for distribution.

From the Etawah Farm 209 maunds of sugarcane were distributed for sowing of the Reora, Saretha and Matna varieties all of which are better than the local Barokha.

Sugarcane is not however a crop of primary importance in the greater part of this circle.

Juar.—Several selected varieties have been tested at the Cawnpore Farm and have done well; the best of these are being tested further and multiplied for seed and 34 maunds of seed has been issued for district trials.

Arhar.—The early ripening arhar referred to in the last report continues to do well. Twenty-five maunds of seed have been issued and the demand is largely in excess of the supply. It is chiefly of value for sowing with cotton and for this purpose the seed issued is sufficient for about 1,000 acres. Experiments are in progress to ascertain if this variety could be profitably grown in conjunction with juar by sowing in drills; when sown broadcast it is smothered by the juar. The importance of an arhar which ripens early enough to escape frost is obvious.

Maize.—Several varieties have been tried and the Jaunpur variety is still the best available. A good deal of this variety is already grown in the circle and cultivators usually reserve their own seed. Seed for about 200 acres was issued from Cawnpore.

Experiments with deep *versus* shallow sowing for maize were made and an increased yield obtained from deep sowing when maize was sown late; this method would appear to be suitable for our lighter soils.

Potatoes.—Experiments were made with hill potatoes from various sources and the same result obtained as last year, viz. that hill potatoes in this neighbourhood yield much less than the local varieties. At Farrukhabad a godown was hired to demonstrate the advantages of storage in sand. One hundred maunds of potatoes were stored and 68½ maunds of good seed sold at a profit of Rs. 349-12-0 or Rs. 3-8-0 per maund stored. As a result some 5,000 maunds has been stored by over 50 growers this year and demonstrations have been extended to three other centres. The potato moth has caused widespread loss in Farrukhabad and potato seed commands a very high price Rs. 7-8-0 per maund being readily paid when our godown was opened by cultivators who sold us potatoes at harvest time at fourteen annas; later on the price rose as high as Rs. 12 per maund. Further inquiry shows that the pest is more widespread than was at first supposed and unless steps are taken to check it a very profitable industry will receive a severe check.

Groundnuts.—The area reported in 1913 from the districts in which demonstrations have been undertaken is 6,500 acres in round figures and it is known that this is below the actual as the patwaris are not yet accustomed to the new crop. Two hundred and forty-six and a half maunds of seed were supplied this year and the crop continues to expand.

Flax.—Flax has again done well at the Cawnpore Farm yielding 26 maunds of straw per acre in spite of a dry season. The percentage of clean fibre in last year's straw is given below:—

Imported 8·3 per cent. to 12·2 per cent. plus 13·3 per cent. to 13·7 per cent. of tow.

Acclimatised 9·0 per cent. to 11·4 per cent. plus 11·3 per cent. to 13·3 per cent. of tow.

This year's crop has not yet been retted. It would possibly pay some of old indigo factories which exist near Cawnpore to take up this crop as their old vats could be used for retting and the cost of the scutching machinery is not prohibitive.

Fodder crops.—Excellent results have again been obtained with lucerne which is by no means new to this province and very high yields of green fodder can be obtained where irrigation is available. Berseem (Egyptian clover) has also shown promise and will be tried further. Guinea grass has shown that in this neighbourhood it is better adapted for dairy farms and sullage farms than for ordinary conditions. Teff (Eragrostis abyssinica) obtained from South Africa has shown great promise. Sown in December it yielded about 4 tons of green fodder (1½ tons of hay) per acre by May the first cutting taking place at the end of March. The grass is soft and fine, seeds freely and cures well to hay and seems likely to be a valuable cold weather annual fodder for irrigated tracts.

General Agricultural Practice.—Green manuring experiments were carried out on a uniform field well situated; the crop grew well and the green manure was ploughed in good time but resulted in a decreased yield obviously due to the failure of the monsoon in September and October. This result is in marked contrast to that obtained at Atarra where in two successive years, in spite of dry seasons, excellent results have been obtained.

Hot weather ploughing for wheat.—The yields of wheat were very clearly in favour of this practice which is adopted throughout the farms and the fact that we were able to sow wheat without irrigation when all neighbouring cultivators required irrigation for *paleo* shows that it pays to take water at a time of slack demand in order to effect a saving later. Similar results were obtained at Atarra.

Late versus *early ploughing for cotton.*—Early ploughing resulted in an increased outturn of 2·3 maunds of *kapas* per acre. Good results were also obtained by sowing arhar juar in lines instead of broadcast and this experiment will be continued.

Implements.—The steam thresher referred to in last year's report continued to give satisfactory results and confirmed the conclusion that it could easily do 100 maunds per day. After the farm crops were finished the thresher worked on contract in villages until the end of May, four annas per maund of grain being charged. Towards the end of season the machine was also used to winnow cultivators' grain (which had been threshed in the ordinary way) at a charge of two annas per maund.

Parmiter's flexible harrow was found useful in keeping down weeds in large fields and American lever harrows (International Harvester Co.) for breaking crusts after rain or irrigation especially after early cotton sowings.

Four handred and eighteen implements were sold to cultivators from Cawnpore and 160 issued to sub-centres during the year and 224 given on hire. The principal issues were 355 ploughs and 95 chain pumps. Sub-centres sold 11 chain pumps, 62 ploughs and three other implements during the year and issued 91 implements on hire. In addition to the above orders for 21 implements including 7 ploughs and 10 chain pumps were passed on to firms for direct supply. The demand for chain pumps was higher than usual owing to the dry season and a considerable number were also sold by firms direct. The total issues of seed from Cawnpore amounted to 4,221 maunds of 61 varieties.

Bundelkhand.

The Orai experimental station is located in the *Kabar* tract of Jalaun, the Atarra station in the *Parwa* tract of Banda district and the Madhogarh demonstration farm in the *Parwa* tract of north Jalaun.

Cotton.—Little work on cotton has been possible at the Orai and Atarra farms as the former consists almost entirely of heavy soil unsuited to cotton whilst the lack of irrigation facilities at Atarra in the early *Kharif* coupled with the late rains made it impossible to do much there. At Madhogarh several types of cotton were tested for suitability to this tract and Mr. Leake's Type 7 yielded far more than any of the local cottons. This cotton is also very favourably reported on by the mills and seed for about 150 acres has been issued this year. If it continues to be a success this variety will next year be issued on a large scale as, from its early habit and hardiness, it appears admirably adapted for a tract where canal water for sowing cannot always be guaranteed.

Reference was made in the last year's report to the arrangements made for irrigated cotton in this tract with the co-operation of the Irrigation department; the crop did very well in spite of the dry season the average yield being from 7 to 8 maunds per acre and an extension of this practice is expected. Unfortunately little, if any, canal water is available this year for cotton sowings the reservoirs having been exhausted during the preceding *Rabi*. The Rath variety of cotton seed issued last year did well and about 200 maunds has again been issued *kapas* having been bought back and hand ginned locally. It is hoped to replace this shortly by Type 7 but as good seed is scarce in this district, Rath seed is issued as the best available.

Wheat.—Of all the wheats tried at Orai, Pusa 4 stood out as the most suitable for those tracts where irrigation could be depended on for sowing, but where subsequent irrigation was doubtful. At the farm the yield was slightly inferior to Pusa 12, but it was obvious that the latter wheat with less careful cultivation (including hot weather ploughing) would probably have failed to mature. As it was the Pusa 12, like many of the local wheats, showed a distinctly shrivelled grain while the Pusa 4 was well matured. At Madhogarh where canal water was supplemented by a *kachcha* well Pusa 12 did best and Pusa 4 also did well. At Atarra Pusa 4 was the best wheat on the farm. Through the courtesy of the Economic Botanist 500 maunds of this wheat is avilable for distribution in Bundelkhand this year.

Soharia, a selected durum wheat, also did well this year. This is intended more particularly for un-irrigated black soils where a durum wheat seems to do best. One hundred and eighty-two maunds was supplied this year and it is hoped to issue about 1,000 maunds for 1914 sowings. A selected Pissi wheat (Malwa) has also done well at Orai and Atarra and there was a considerable demand for seed, especially at Atarra.

Juar.—From the collection of Bundelkhand juars several types have now been selected that give higher yields than the local mixtures; these have been distributed for demonstration purposes and the best types are being multiplied.

Arhar.—The early ripening variety of arhar has also done well at Orai and there has been a considerable demand for seed from the north of the Jalaun district.

Sugarcane.—This crop does very well at Atarra and with regular *kharif* irrigation would spread in the neighourhood. Ashy Mauritius, a variety recommended by the Agricultural Chemist, has done best, yielding about 35 tons of cane per acre and 5 tons of *gur* per acre. A number of varieties of *ukh* have also done well. For the present, sugarcane is grown on a small scale under well irrigation supplemented by canal water when available in order to have good varieties for distribution when the completion of Gangao dam makes general cultivation possible.

Rice.—The canal tract near Atarra represents the only really important rice growing area in Bundelkhand. Experiments at the farm have shown that the yield of the local varieties can

be greatly enhanced by transplanting instead of sowing broadcast and also that there are several varieties that yield better than the local—both broadcast and transplanted. Demonstrations are now in progress at Baberu.

General agricultural practice.—Hot weather ploughing for wheat has given successful results at both Orai and Atarra the effect on the crop in the past season, when practically no irrigation was available after sowing, being very marked. Irrigation for early ploughing is rarely available but with Ransomes "*Pathartor*" plough it is possible to plough the land with a reasonable expenditure of cattle power. In a good year the enhanced yield more than repays the expenditure on ploughing and in a year of short rainfall early ploughing makes the difference between a fairly good crop and a bad one.

Green manuring has given consistently good results at Atarra in spite of two dry seasons.

At Orai it has been definitely shown that a rotation of wheat and gram pays much better in every way than the local system of mixed cropping both as regards yields of wheat and of gram.

The Atarra farm supplied this year 432 maunds of seed of which the principal items were wheat 301 maunds, ground-nuts 49 maunds, juar 11 maunds, rice 39 maunds the number of purchasers being 542.

The Orai Farm supplied 1,343 maunds of seed of which the principal items were wheat 348 maunds, juar 863, cotton 123, ground—nut 3, early *arhar* 4 maunds and *Tilli* 14 seers.

Implements.—In addition to the Pathartor plough mentioned above the Monsoon plough has been found particularly useful on the *Kabar* and *Mar* soils while around Atarra the Meston plough is becoming popular for the light *Parwa* soils.

The Atarra farm sold six ploughs during the year and hired out 55 implements during the year mostly ploughs and chain pumps—some of these are now being purchased on the instalment system.

Eradication of kans.—Experiments at Orai have clearly proved that this pest can be brought under control by deep ploughing followed by *rabi* cropping in the next season. The amount of bullock power required to clear fields of *kans* is however prohibitive, but the fields can be kept clean once cleared. A small motor plough is being obtained to ascertain if by this means fields can be sufficiently cleared to permit of cultivation.

General.

A feature of the year's work has been our closer relations with Co-operative Societies. The Sandila (Hardoi) and Jasrana (Mainpuri) Societies have now started seed stores and are working in touch with us in introducing Pusa wheats, selected varieties of cotton and, to a lesser extent, other crops. An integral portion of the scheme is the arrangement by which the seed store shall take annually from the department a prescribed quantity of pure seed which is issued to selected growers for multiplication to form the stock for general issue in the ensuing year. In the case of wheat especially it seems clear that only by arrangements of this kind can the department control enough seed to effectively replace inferior varieties in large tracts. There is at present no unofficial agency that could take over approved varieties for multiplication and issue nor are existing conditions such as to attract capital for this purpose. With the assistance of the Co-operative Societies a seed farm of moderate size can supply a large area.

Seed has also been supplied on a large scale through the Unao Town Bank and the societies subordinate to it, through the Hardoi Bank and to a smaller extent through the other Co-operative Banks of the circle. With the exception of American cotton seed and seed supplied to Court of Wards Estates, the bulk of our seed has this year been issued through Co-operative Banks. Two agricultural assistants are now exclusively employed in connection with demonstrations carried out through the members of the Co-operative Credit Societies in Unao and Hardoi districts.

The Etawah Demonstration Farm has materially assisted to arouse interest in the work of the department amongst cultivating zamindars and larger tenants and a keen demand for seed has arisen.

The Mainpuri Agricultural Association now has its own demonstration farm. The department provides a fieldman, implements and supervision, while the Association has made itself responsible for the ordinary expenditure and takes the receipts; extraordinary expenditure is met by the department.

Agricultural exhibitions.—District exhibitions were held at Etawah, Sitapur (Khairabad), Hardoi, Unao (Takia) and Mainpuri the latter managed by the Mainpuri Agricultural Association. An exhibition was also held at Gauria (district Unao) under the management of Gauria Co-operative Society. Exhibits of agricultural produce and implements were sent to all these and the department also arranged for the judging of cultivators' exhibits. Vernacular lectures on agriculture were given illustrated by magic lantern slides. At the larger exhibitions through the kind assistance of the Agricultural Engineer power pumping plant was shown at work and also other plants, such as flour mills, suitable for small oil engines. At Mainpuri demonstrations of steam-threshing were given.

In point of numbers and exhibits the Etawah Show was the best in the circle and considerable sales of agricultural exhibits were effected. The Mainpuri exhibition was of particular interest in respect of the number of exhibits (150) of varieties of crops recommended by the department.

A feature of the Hardoi exhibition was a joint Co-operative and Agricultural Conference which afforded a most useful opportunity of meeting the representatives of the branch banks. At the Gauria show also a large proportion of the exhibits represented crops grown from seed supplied by the department.

A statement of receipts for the circle is attached; the receipts from the Madhogarh and Etawah Demonstration Farms were nominal as this was their first year and most of the produce was sold for seed after the close of the financial year.

Agricultural education.

Two village school teachers referred to in last year's report have returned to schools in the Etawah district and have carried out demonstrations of crops recommended by the department with the co-operation of the local zamindars. Three more Etawah teachers were trained during the year and have just returned. Two teachers have now been sent for training by the Allahabad District Board and four by the Etawah District Board. As this experiment came in for rather more discussion than it deserved from the Committee on Primary Education, it is perhaps desirable to explain that no attempt is being made to teach either scientific agriculture or "Nature Study" to these men. The teachers deputed to Cawnpore are merely given an opportunity of learning practical agriculture as carried out in the Cawnpore farm so that on return they may act as an additional link between the department and the villages. Success can only be expected where men with a strong agricultural bias are selected and where on return they can be posted to villages for which the department has definite recommendations and where it is prepared for organised demonstrations.

Publications.—Articles on American cotton, Steam threshing, Steam ploughing and a note on potato storage were published in the Agricultural Journal of India.

Vernacular pamphlets were published on Sann Hemp, Potato Storage, *gur* Making and Manuring and new editions of pamphlets on American cotton, the Moth Borer and Cotton cultivation. A new pamphlet on ploughs and ploughing is in the press. The staff of the circle contributed 16 articles on matters of practical importance to the departmental Verncular Journal—the Mufid-ul-Mazarain.

Correspondence.—The number of letters received was 4,718 and issues 4,974. Applications for agricultural advice numbered 839.

B. C. BURT,
Deputy Director of Agriculture.

APPENDIX III.

Report on the administration of the Eastern Circle of the Department of Agriculture, United Provinces for 1913-14 *by Mr. L. C. Sharma, Assistant Director of Agriculture.*

Tours of officers.—The post of the Assistant Director of Agriculture is held by Mr. L. C. Sharma who remained in charge throughout the year under report.

Experimental investigation.—The experimental work at the Benares and the Partabgarh Agricultural stations during the year under report mainly concerns—

(1) *Sugar canes.*—The methods for improving sugar canes consist of—

(*a*) Trial of cultivation experiments such as seed rate; ordinary versus improved cultivation.

(*b*) Trial of varieties in order to test their relative merits as sugar yielders. Also manurial experiments.

Thick canes.—The results obtained show that the sowing of thick canes in trenches 18″ deep secures a higher outturn. Mauritius No. 16 gave 102 Maunds of superior quality *gur* per acre on the Partabgarh Agricultural station. Many Zamindars and cultivators tried this method and they were all satisfied with the result. Several cultivators in the Bara Banki district obtained from Rs. 500 to Rs. 700 per acre.

The seed canes of thick varieties over 8,000 in number are sold to Zamindars and cultivators this year.

Thin canes.—Reora and Saretha varieties which have given good results on the Benares and Partabgarh Agricultural stations, are taking the place of inferior local varieties such as Reori, Ramui (Chin), &c.

Saretha of Muzaffarnagar and Ramgoal of Allahabad gave 6,996lbs. and 5,608lbs. of *gur*, respectively, at the Benares Agricultural station.

Seed canes of Reora and the Saretha varieties amounting to over 500 mds. in weight were distributed last season.

Seed rate 18,000 cuttings per acre gave the best results.

(2) *Wheat.*—Varietal experiments with this crop to determine their suitability to the locality in addition to the seed rates, early and late sowing, and the green manuring versus fallow or Farm yard manure experiments.

Pusa No. 12 has given the best results and the following statement shows the actual outturns.

Place.	Grain.		Bhusa.		Remarks.
	Mds.	Srs.	Mds.	Srs.	
Benares ..	28	2	34	32	
Partabgarh ..	25	30	46		
Sultanpur ..	35		52		
Bahraich ..	40		55	20	The harvesting and threshing was done under the supervision of the Deputy Commissioner, Bahraich.

Mr. A. Howard, the Imperial Economic Botanist, during his visit to the Partabgarh Agricultural station about the beginning of March inspected wheat crop Pusa No. 12 in a number of cultivators' fields in several villages. He estimated the outturn of wheat to be over 25 Maunds per acre in almost every case.

To meet the increasing demand for Pusa No. 12 six hundred maunds of seed has been purchased from Mr. E. Danby, Dholi Factory, Bihar. Suitable arrangements have been made for sowing this seed on large areas by some of the most interested Taluqdars and cultivators under the supervision of the Circle Staff, and the whole outturn of the grain can be secured for Department if necessary to meet the demand in future.

The seed rate 40 to 50 seers per acre and its sowing about the middle of October have given good results.

(3) *Paddy.*—The methods of improving paddy cultivation consist of—

(*a*) Varietal experiments to determine their suitability to the locality.

(*b*) Seedling experiments (i. e. the transplantation of one, two, and three seedlings of Hansraj variety are compared to ascertain which process will prove more profitable) and

(*c*) Spacing experiments (i.e. transplanting 4″, 6″, and 8″ apart of one seedling in one set of the plots, of two seedlings in the second and of three in the third to determine which course gives the best results).

Twenty selected varieties were tried this year. Hansraj, Bansmati and Bansphool of Bengal varieties have given the best results which are shown in the following statement:—

Hansraj	..	.. 2,480 lbs. per acre.
Bansphool	..	.. 2,160 „ „ „
Bansmati of Dehra Dun		.. 1,872 „ „ „

Several Zamindars and cultivators who tried the above varieties got similar good results. The demand for these seeds sprung up very rapidly and sufficient seed to cover 200 acres has been distributed to men from whom the whole produce can be secured to meet next year's demand, if necessary.

Transplanting of one seedling at 6″ apart or two seedlings at 8″ apart has given the best results.

Latter half of July appears the best time for transplanting rice, if circumstances permit.

(4) *Groundnuts.*—Varietal experiments with these crops are being conducted to determine their suitability to the locality. The results of this year and those of the last, show that the large Japanese variety will make a very profitable crop in this circle. The demonstrations which were given with this crop in certain villages and the demonstration farms of various districts met great success giving an outturn up to 32 maunds per acre in several cases.

The area under groundnuts has increased from 2 acres to 300 acres during the last 2 years. Over 500 acres are expected under this crop next year.

5. *Maize.*—Jaunpur variety has again given the best results, and the above-mentioned Agricultural stations. A large number of people also tried it under the instructions of the Agricultural Staff of this Circle, with excellent results. There was demand for 175 maunds of this seed but 81 maunds only could be procured and supplied. People purchased all this quantity at 5 seers a rupee which shows their keenness. They are appreciating the value of sowing maize after the dibbling and drill processes which bring much higher outturns than that of broad cast sowing adopted all over the circle.

6. *Cotton*—Varietal experiments with this crop in order to determine their suitability to the locality are being conducted. Yellow flower and Buri variety have given the highest results so far.

Cotton is practically a new crop in this circle but from the results so far obtained there appears to be a vast scope for its successful introduction.

A large number of varieties have been put under trial on both the Agricultural stations and some more definite information may be available next year.

Some seed is also being tried in some of the interested cultivators' fields in a few districts of this circle.

Eradication of Roshna *and* Rarhi *weeds.*—Deep ploughing with iron ploughs has given satisfactory results for the eradication of Roshna and Rarhi weeds in the Jaunpur and the Ballia districts, respectively, and several cultivators have adopted this system and taken wheat crops on the area recovered.

Green manuring.—The green manuring with sann hemp having given good results again this year on the Partabgarh and the Benares Agricultural stations 150 maunds of sann hemp seed was purchased and supplied to some of the interested Zamindars and cultivators for trial as green manuring.

Many cultivators have begun to enrich their fields with green manure as they find it the cheapest form of manuring which also increases the moisture-retaining power of the soil.

Dofasli rotation experiment.—(i.e. two crops in rotation in the same year). The results of this experiment show that a crop of peas, potato or tobacco can be taken successfully in rotation with Groundnut crop by sowing the latter one month earlier than the usual time.

In spite of the bad season Groundnut and Potato rotation gave Rs. 180-14-6 net profit per acre, while that of maize and Potato Rs. 284-1-3 at the Benares Agricultural station.

Preservation of fodder in a silo.—As suggested by the Director this experiment was carried out in the compound of the Co-operative Dairy at Paharia (Benares) with a view to see how far success can be achieved in preserving the green fodder purchased when easily available to be utilised in months of scarcity.

The experiment was conducted with chaffed and unchaffed green juar fodder in two kachcha silo pits separately.

The results of the experiments which met the entire satisfaction of the members of the dairy showed that the green fodder could be well preserved throughout the hot weather and that the ensilage made was well relished by their cattle and at the same time much cheaper and more nutritious, although the cattle did not seem to have liked it in the beginning for two or three days. The unchaffed fodder did comparatively better.

The ensilage made gave us 8·45 per cent net. profit in spite of the fact that it was sold away on an average at about 2 maunds and 20 seers a rupee when the market price of ordinary Bhusa was about one maund a rupee.

Some of the cow-men are arranging their own silo pits for next year. The inspecting authorities of the dairy have also much appreciated the results of this experiment.

Seed Dépôts.—There are now 16 seed dépôts in this circle, out of which three are financed by District Board, Fyzabad, one by District Board, Sultanpur, and the rest twelve by the Department. They include the five new ones opened this year. All the inferior seed of these seed dépôts has now been replaced with the superior and improved seed. Fourteen thousand one hundred and eighteen maunds of this seed (i.e. 11,301 maunds Rabi and 2,817 maunds Kharif) as detailed on the margin, against 13,379 maunds in the previous year, was distributed this year for sowing purposes on usual terms of the Department.

	Mds.	sr.	ch.
Wheat ..	5,287	22	5
Barley ..	3,495	3	12
Oats ..	9	24	0
Gram—desi	907	1	8
Gram—Kabuli	7	16	8
Peas ..	1,589	28	12
Other rabi seeds	4	28	0
Dhan early..	2,823	26	6
Dhan late ..	455	36	4
Groundnuts	20	0	8
Other Kharif seeds	17	19	9½

The advantages of our seeds over the local seeds generally sown are that :—

(1) They are sown 20—40 per cent. less per acre owing to their germinating power being very good.

(2) They give on an average about 40—80 per cent. higher outturns.

(3) The outturns are of superior quality which find a ready market and fetch, comparatively, a higher price.

Arrangements have been made to renew ¼th of the seed stock every year and keep it pure and separate from the rest by confining its distribution only to certain limited localities of a district or districts.

Demonstration given with improved seeds.—Most of the Zamindars and the cultivators are beginning to realize the advantages of our seeds but in order to impress them well with the advantages, 564 demonstrations with various seeds, which were sown in their own fields under our instructions and supervision, were given this year in eight districts of the circle.

The outturns of about 90 per cent. of the crops treated as demonstrations, mentioned above, was extraordinarily good and gave much satisfaction not only to the zamindars and cultivators concerned but to a good many others as well.

Another good result of the demonstrations given is that a far greater demand for superior and improved seeds has sprung up. Several private seed dépôts will soon be opened. District Board, Sultanpur has already opened a seed dépôt under supervision of the Assistant Director.

Demonstration Farms.—Now as the work of the Government Agricultural Stations in this circle has begun to give some definite results, the scope for work is considerably increased and in order to familiarise the zamindars and cultivators with the proved improvements and the real benefit they could derive therefrom, demonstrations on large scales were given this year on areas which are taken from Municipal Boards, Nazul authorities or some landholder, either on an annual lease or free of rent.

All these areas are well situated and called as demonstration farms each of which is put in charge of an Agricultural Overseer or a fieldman as shown below :—

Serial number.	Name of the Farm.	Area in acres.	Official in charge,	Remarks.
1	Jopling Demonstration Farm, Ballia.	12	Babu Mata Prasad (Agricultural Overseer).	It is financed by the District Board.
2	Ghazipur Demonstration Farm	2·81	M. Afzal Husain (Agricultural Overseer).	Doing good work.
3	Turner Demonstration Farm, Rae Bareli.	11·65	Babu Puttu Lal (Agricultural Overseer).	It has already made a name for cotton and Pusa wheat.
4	Bara Banki Demonstration Farm.	16·22	M. Nihal Ahmad (Agricultural Overseer).	Has introduced thick varieties of Sugarcane in the district.
5	Bahraich Demonstration Farm	3·5	Munshi Ram Sarup (Fieldman)	Has introduced thick varieties of Sugar cane in the district also Pusa wheat and Jaunpur Maize.
6	Fyzabad Demonstration Farm	17	Thakur Gopi Nath Singh (Fieldman).	
7	Sultanpur Demonstration Farm.	7·47	Babu Bhagwati Prasad (Agricultural Overseer).	Gave a net profit of 72 per cent.

These farms did a very useful work indeed and it is chiefly because of this and the results of the demonstrations given in the cultivators' fields that 36 private farms are opened in the circle during the year under report.

Private Farms.—It is very satisfactory to note that a good many of the Taluqdars and other big landholders have now started appreciating the work of the Government Farms (including demonstration farms) in right earnest and are very keen to improve the agricultural conditions of their respective estates. Some of them have opened Farms of their own with the following objects in view :—

(1) To grow improved seeds and to serve as seed dépôts.

(2) Trial of crops and improved methods of cultivation that proved successful on the Government Farms of this circle.

(3) To familiarise the cultivators with the growing of more profitable crops and the use of the improved seeds and the methods of cultivation.

There are now 40 private farms in this circle in place of four only in the previous year, and the Department is giving them as much help by way of advices and instructions as is possible under the circumstances.

Agricultural shows.—Eight Agricultural Shows, against five in the previous year, took place during the year under report.

They were held at—

1. Dewa (Bara Banki.)
2. Dadri (Ballia.)
3. Rae Bareli.
4. Sultanpur.
5. Debi Patan (Gonda).
6. Fyzabad.
7. Bahriabad (Ghazipur).
8. Chakia (Benares State).

The last three are new additions. Every one of them was attended by several members of the subordinate Agricultural service while the first six were supervised by the Assistant Director of Agriculture.

In every Agricultural show a number of improved seed grains and other products produced on the Government Agricultural Stations and the demonstration Farms of this Circle were exhibited and lectures on various Agricultural subjects and the demonstrations with improved implements and machines such as Meston Plough, Cultivator, Harrow, Chaff Cutter, Grain Kibbler, Maize huller, Winnower, and chain pumps, &c., were given on the spot to explain the advantages of each and every one of the exhibits and the real value of the demonstrations given. The large number of Meston Ploughs and other agricultural machines and large quantities of the various improved seeds sold away at these Exhibitions go to show the extent to which the work of the Department was appreciated by the Zamindars and the cultivators.

In Fyzabad exhibition crops such as groundnuts, early Arhar, Cotton, Jaunpur Maize, &c., were actually grown in the exhibition area and the standing crops were shown to the people at the Exhibition time.

Sale of Agricultural machines and implements through the Government Farms of this Circle.—The facilities created by the increased number of the Agricultural Exhibitions and the useful function discharged by the various district demonstration Farms, in bringing the public in touch with the work of the Department, have raised the demand for improved Agricultural appliances, specially for Meston Ploughs.

The following statement shows the sale of improved Agricultural machines and implements from the Government Agricultural Stations and the demonstration Farms during the year under report.

Statement showing the sale of improved Agricultural Implements during the year ending 30th June 1914.

Serial No.	Name of implement.	Sold from				
		Partabgarh.	Benares.	Rae Bareli.	Ballia.	Total.
1	Meston Plough.. ..	54	16	20	2	92
2	Shares for Meston Plough ..	31	..	..	..	31
3	Watts' Chain Plough ..	3	2	3	4	12
4	Watts' Beam Plough ..	1	..	..	..	1
5	Chaff Cutters ..	3	2	1	..	6
6	Blades for Chaff cutters ..	Prs. 4	..	..	..	4
7	Wheel No. E-24 for Chaff cutter,	1	..	..	..	1
8	M. M. O. Kibbler ..	1	..	..	..	1
9	Bullock Cultivator ..	1	..	..	..	1
10	Iron Maize shellers ..	30	..	..	..	30
11	10 ft. Chain pump ..	1	..	..	..	1
12	Baldeo Balti ..	1	..	..	..	1

The Vernacular monthly journal.—The Journal known as Rissala Mufidul-Mazarain was issued regularly throughout the year under report. Two hundred and forty-eight new subscribers are added to the list and were it not for the copies which the Zamindar Association has discontinued, the number of circulation would have increased for the year by far.

Ninety-seven articles on various important Agricultural matters appeared in the Journal, some of which were reproduced by a few other vernacular journals. It serves to a considerable extent in meeting the requirements of the people who are anxious to know what Agricultural improvements have been made and that what benefit and how they can derive from them.

L. C. SHARMA,

Assistant Director of Agriculture.

APPENDIX IV.

Report on the administration of the Botanical section by H. M. LEAKE, ESQ., M.A. (CANTAB) F. L. S., *Economic Botanist to Government, United Provinces.*

Charge.—From the commencement of the year under report until 13th March 1914 I was on combined leave and charge was held by Mr. A Wilson, Assistant Economic Botanist. From the 7th May I officiated as Agricultural Chemist for Mr. Clarke on leave.

Investigations on leave.—Opportunity was taken of my presence in England to visit the British Cotton Growing Association and the International Federation of Master Cotton Spinners and also various persons connected with the cotton industry both as brokers and manufacturers. In view of the fact that the Indian barley crop is assuming a position of considerable importance, the opportunity was also taken of getting into touch with persons engaged in the barley trade in England and Ireland and the association thus formed should be of considerable value in the work on barleys which it is now proposed to take up.

During the winter months I obtained facilities for work at the Imperial College of Science where I was enabled to work out certain points in connection with the ginning per cent. of cotton. For the facilities there afforded me I am indebted to the authorities of the College and especially to Professor J. B. Farmer, F.R.S.

Publications.—The results of the work completed at the Imperial College of Science have formed the subject of a paper appearing in the Journal of Genetics.

Research.—The chief research work accomplished during the year has already been referred to. The characters on which the ginning per cent. of any type of cotton depend, have hitherto been unknown. The necessity of obtaining a high ginning per cent. is of great practical importance and it is hoped, that these investigations will render it possible to breed out at will, cottons which possess this character in high degree.

Owing to the rapidity with which cotton seed loses its germinating capacity, it was not feasible to put the seed by for a year. The crop had to be grown and a large amount of detailed work was involved. I cannot omit this opportunity of expressing my indebtedness to Mr. Wilson for the zeal and energy with which he carried out this arduous duty.

My return from leave was timed to fit in with the wheat harvest which I was thus enabled to reap in person. The survey of the provincial wheats is now practically complete and I hope shortly to be in a position to write up these results.

Seed farm.—The year under review is the first complete year of the Seed Farm recently established at Kalai in the Aligarh district. This farm is conducted chiefly on a wheat-cotton rotation, the land being ploughed up immediately the wheat or cotton crop is removed and allowed to lie fallow during the hot weather. The introduction of a steam threshing plant is of material advantage in this respect as cattle power is thus available for ploughing. The farm, though not intended for demonstration, attracts a good deal of interest in the locality and signs are not wanting that some of the methods are being given a trial on the neighbouring lands. During the year the farm buildings have been completed, a small power ginning plant and steam thresher and bhusa maker have been installed. The season has been far from favourable. The monsoon gave only 3·05 in rain after July and the canal did not open till the end of November and in consequence the wheat sowings were much damaged.

The main object of the farm is to provide trial ground for new varieties evolved on the botanical area and to supply for distribution a bulk of pure seed of such kinds as pass the trial stage successfully.

Insufficient cotton seed of selected races was available for sowing and the bulk of the kharif area of the farm was sown to Dr. Parr's Aligarh white flowered cotton. A small area was sown to a selection known as K. 7 raised on the botanical area. The latter kind appears to be particularly suited to Bundelkhand and is well reported on; over 20 maunds of seed has been supplied for extended trial in that area.

Owing to the late arrival of the canal the bulk of the wheat area was sown to Pusa 4 wheat, which requires a very short season, and of which, in spite of the late sowing, the heaviest yield harvested from a single acre was 32 maunds. The next highest acre yield—one of 28 maunds—was given by a selection from the provincial wheats. Five hundred maunds of Pusa 4 have been supplied to Bundelkhand for which tract this kind, owing to its short period of growth, has proved especially suitable.

The expenditure on the farm amounted to Rs. 11,640 of which Rs. 3,452 was on capital account, leaving a sum of Rs. 8,188 as the cost of working. The income derived from sale of produce was Rs. 8,909.

Teaching.—The courses in Botany and Zoology in the Agricultural College have formed, as in previous years, an item of my programme.

H. M. LEAKE,
Economic Botanist to Government,
United Provinces.

APPENDIX V.

Report on the administration of the Chemical section by MR. G. CLARKE, F.I.C., *Agricultural Chemist to Government, United Provinces.*

Agricultural college.—I remained in charge of the teaching of the Chemical and Physical side of the college, which was as in former years conducted in the laboratories of the Chemical section under my control.

The courses in Chemistry and Physics were revised as a result of the removal of the Kanungo students.

I gave a course of lectures to the first year students (throughout the year) and supervised the practical work.

Analytical and advisory work.—One hundred and fourteen samples of agricultural products have been analysed and reported upon during the year under report. It is proposed to publish in the form of a departmental bulletin selected results of the analysis of Agricultural products.

Publications.—A bulletin on "Cane crushing in the United Provinces" has been published by the Imperial department. It contains results showing the relative milling properties of United provinces canes; the efficiency of some types of bullock mills, and suggests certain directions in which it may be desirable to experiment with a view to extending cane cultivation.

A paper has been published in the transactions of the Chemical Society of London on Phytin and Phytic acid. It deals with the scientific side of a series of important compounds occurring in plants; a knowledge of which was necessary for an investigation of Indian cereals.

Sugar experiment station, Shahjahanpur.—The equipment and charge of this station occupied considerable time. The success of this work entirely depends on a satisfactory water supply; without it the work of years may be destroyed in a single season. There were considerable difficulties at first in obtaining water, but these have been largely overcome; and the discovery of an excellent spring in one of the two wells, and the installation of a powerful pumping plant by Mr. Vick, Agricultural Engineer, has facilitated the work this season. The second well is not yet yielding a good supply but boring operations are in progress.

The work in progress may be mainly divided into two parts :—

(I) The collection and isolation of pure cultures of indigenous varieties, the investigation of their milling properties, sucrose content and general crop characters with a view to selecting the most suitable for general cultivation.

(II) The collection and supply of the principal varieties of other cane-growing countries to ascertain if any improved varieties can be acclimatized and grown under intense culture on a field scale in Rohilkhand. So far two varieties have given very promising results and considerable quantity is available for distribution this year.

The varieties are—

(I) Ashy Mauritius, imported from Mauritius.

(II) J. 33 a variety obtained from Dr. Barber, sugarcane expert by whom it was imported into Madras.

Other work.—The necessary sanction having been obtained I acted as one of the examiners in the final M.Sc. examination of the University of Allahabad.

I held charge of the combined library, until return of the Economic Botanist, from leave.

G. CLARKE,
Agricultural Chemist to Government,
United Provinces.

APPENDIX VI.

Report on the administration of the Agricultural College, Cawnpore, for the year 1913-14, *by* MR. A. W. FREMANTLE, *Principal.*

The College was visited by His Honour the Lieutenant-Governor of the United Provinces in August 1913.

In accordance with the Government orders the students nominated for kanungoship ceased to be educated at the College after the annual examination in September 1913. Those who had salready passed the 1st and 2nd year examination, i.e., 27 and 28 respectively, completed a survey course in other districts and for those recently nominated, a Kanungo School was started which is for the present domiciled in some of the college buildings until quarters can be found for them elsewhere.

The remaining students in the 2nd and 3rd year proceeded with their course and a new class of 10 was admitted, three of whom are sons of well-to-do zamindars.

The course was extended from two and a half years years to three years and in consequence of which the diploma examination usually held in March will be held in September.

By a recent order of Government of India, scholarships amounting to a total of Rs. 80 per month have been allotted to the college from the special grant for technical and special education to be given to sons of landholders and it is hoped that this will lead to a large number of landholders' sons entering the college.

A. W. FREMANTLE,
Principal,
Agricultural College, Cawnpore.

APPENDIX VII.

Report on the administration of Agricultural Engineering for the year ending 30th June 1914 *by* MR. F. H. VICK, M.I.M.E., *Agricultural Engineer.*

For the first 3½ months of the year (July 1st to October 15th) the office of Agricultural Engineer continued to be run much as in the previous year there being no permanent incumbent of the office during this period. Mr. Burt, Deputy Director, Central Circle, gave assistance in the control of the office and workshop staff of the Engineering Branch as heretofore, whilst I continued to advise the Department in Technical matters from my head quarters at Roorkee, the files being sent to me there for reports and replies. I also paid occasional visits to Shahjahanpur to inspect the construction of Buildings, Wells, &c., for the New Sugar Experimental Farm, and to Cawnpore to see to certain office and workshop cases and to consult with officers of the Department on Engineering works in progress or contemplated.

I joined the Agricultural Department permanently as Agricultural Engineer on October 16th, 1913, and the remarks following will relate chiefly to the period of 8½ months from then to the end of the administrative year. The work undertaken in the Engineering Branch is of a very diverse description so I will divide it up under various heads and give a short account under each, of the progress made.

(1) *Construction of Buildings and Erection of Machinery on the Experimental Farms of the Department.*—Shahjahanpur Farm Buildings which I had started in the previous year were pushed on to completion and by December were ready for occupation. The question of Irrigation for the Farm resolved itself into the choice of schemes of (*a*) lifting water from the small river Khanaut which runs about two furlongs from one end of the farm and (*b*) the construction of *pucca* wells on the Farm. It was decided to adopt the latter scheme and the sinking of two large *pucca* wells, 10 feet inside diameter, was taken in hand. Both have been completed as far as sinking goes and the East well has been very successfully bored and now gives a constant yield equivalent to 12 charsas of water (16,000 gallons per hour). An Oil Engine and Pump was installed on this well and water was lifted for irrigation of canes all through the hot weather and during some breaks in the rains. The West well is now undergoing a boring process, as it at present only gives one charsa yield of water. I hope to turn this well also into one yielding at least 10 to 12 charsas and capable of keeping an Engine and Pump going for 10 or 12 hours a day. The success or otherwise of this well-boring will be reported on further in the next report.

A scheme of Irrigation for the Farm at Gorakhpur is under consideration, the likelihood being that Tube wells will be adopted, there being some difficulty in making successful *pucca* wells in the district owing to the absence of a good "mota."

At Kalai Farm (Aligarh district) a Cotton-Ginning house was built for the Economic Botanist and Cotton Gins, shafting, &c., installed.

At Cawnpore Farm an Irrigation scheme was carried out for the Economic Botanist, water being pumped from the tank and led through a pipe line to a masonry channel on the side of the Cotton plots. This scheme was useful in starting the Cottons of Economic Botanist at a time when no canal water was available and the monsoon rains had not been established.

At Nawabganj Farm (Bareilly district) a Tube well was sunk for supplying water for irrigation. The large head-pipe for the Tube-well has recently been put in and it is hoped to get good irrigation done from the well during the coming dry season.

(2) *Installation of Machinery for Pumping and Industries.*—This branch of work has made extremely good progress during the official year, and the outlook is very hopeful for the adoption of power pumps on a large scale in this province, in the near future.

The Installation of engines and pumps has received a stimulus by the stocking of engines and pumps on a small scale in Cawnpore. Formerly, without such stock, I could only order an engine and pump from the makers or Agents upon getting a definite order from a client for it, and often had to wait for several months before I could get the plant delivered to me for erection. This long delay disheartened the zamindar and made him disinclined to go in for pumps at all. After exhaustive trials of various makers' pumps and engines, I have now settled on one make as being in front of others from a point of view of reasonable cost, reliability, simplicity, and efficiency and I now stock a few of the smaller sizes of these pumps and engines. I can thus supply a client immediately upon his order for the plant if it is in a small size. The advance I have been given for the stocking of pumps is only half what I asked for and my work in this direction would gain a lot by the granting of a larger sum.

The system adopted, upon receiving an enquiry for pumping plant, is to visit the site of the proposed scheme and if it offers favourable conditions to apply to the Collector of the district for "takavi" for the client up to the amount of the estimated cost of the plant. The Collector of the district of course knows the financial resources of his zamindars better than this department, and is well able to find out whether "takavi" can be given or not. This system is quite safe from the point of view of this department as bad debts will never be incurred.

The following is a list of some of the plants erected and in course of erection :—

Serial No.	Name of place.	H. P. of plant.	Water pumped per day of 12 hours in gallons.
1	Babugarh	50	1,890,000
2	Allahabad	25	720,000
3	Safipur	25	180,000
4	Fatehgarh	25	1,440,000
5	Saroura	14	800,000
6	Kamalganj	6	Flour milling.
7	Mainpuri	17	120,000
8	Shahjahanpur ..	7½	180,000
9	Shahjahanpur ..	11	200,000
10	Banda	Pump only set up.	170,000
11	Kanth	10	192,000
12	Moradabad	6	216,000
13	Kalai	10	Cotton-ginning.
14	Cawnpore	7½	360,000
15	Nawabganj	6	216,000
16	Muttra	10	720,000
17	Muzaffarnagar ..	9	180,000
18	Balrampur ..	5	216,000
19	Fyzabad	5	120,000
20	Aligarh	10	Threshing &c.
21	Unao district ..	9	500,000
22 to 31	Bulandshahr district ..	About 10 sets of 7 H. P.	About 108,000 gallons each of 10 sets.

The above list will show that a good start has been made with power pumping. It is a very great advance over previous years, never before have more than 2 or 3 small sets of about 3 or 4 H. P. been installed in one year for pumping. A pleasing point too about it is the wide area over which the work is spread, the places mentioned comprising all quarters of the Province. I have a big list of enquiries in hand for inspection of sites for pumping and hope to instal a good number of sets during the coming season.

In the list Nos. 22 to 31 (about 10 sets) have been installed by an Indian Agent in the Bulandshahr district for pumping from wells and under an arrangement made by Dr. Parr, Deputy Director, Western Circle, to whom I lent a Mechanical Assistant for the supervision of the work. I did not myself personally see to this group of Pumping Sets.

In a great many cases the engines are used for running ata grinding mills, Cotton Gins or Oils Mills as well as for driving pumps. The Agricultural Department thus has to instal machines for such minor industries as mentioned above besides the work of erecting Power Pumps. It is very difficult to separate Industries from Agriculture in these cases, as a refusal on our part to put down Industrial Machines would mean in a good many cases, the refusal of a client to have a pump and engine at all.

There is an absence of good Drivers for the engines very frequently and this causes some inconvenience. For small sets I have started a system of taking in a man from the zamindar who is putting in a pump, and training such man for a couple of months, free of cost, in the Cawnpore Workshop.

For big sets such a training is insufficient though, and I have difficulty in getting good men for these. I understand an Oil Engine Driver Class is being formed in the Lucknow Technical School and I am hopeful that good Drivers will later on be available from there.

I am encouraging as far as possible the installation of *big* Pumping Sets, as such hold the advantage in every way over small plants. The cost per unit area for irrigation, with say a 25 H. P. set, comes to just about half that for watering with a 7 H. P. set, other conditions remaining the same. The matter is, of course, governed by the amount of water available and

in the case of pumping from wells and some small rivers or jheels it is not possible to put in a big pumping set.

3. *Inspection of Wells and Sites for Pumping.*—I have visited and inspected more than two hundred proposed sites for pumping in various parts of the Province during the year under report. About 70 per cent. of enquiries are for pumping from wells and in a big proportion of these cases the installation of a power pump is not a paying proposition the yield of water being too little. It does not pay to pump water, for ordinary field crops, from anything less than a "six-charsa" well, i.e. a well which will yield enough water to keep six big charsas working together for several hours continuously.

There are a very great number of good pumping sites on the rivers of the Province and I am confident that in the near future pumping for irrigation will be resorted to on a very large scale. I have put down several such big sets during the past few months and these are attracting the attention of the zamindars near round.

I am hampered in this Inspection work by having insufficient Staff. It is impossible for me to personally visit all enquiries for inspection of sites. In this work alone there are sufficient enquiries to keep two assistants constantly on the move over the Province. It must not be forgotten that I have the whole Province to attend to in this line and at no very distant date my staff must be very much increased or else enquiries after machinery will necessarily be neglected.

4. *Experimental work on spring and percolation wells.*—The actual construction of *pucca* spring wells by this department at Shahjahanpur Farm gave a very fine opportunity for experiment, to see if the ordinary one or two-charsa well of the district could not be greatly improved upon. After the masonry cylinder had been sunk on the East Well I made some experimental borings in the bottom of the well to different water-bearing strata beneath. Not tapping sufficient water with a 4" boring to the first and second water-bearing strata, I carried down a 6" tube for 106 feet beneath the bottom of the well to a good water-bearing sand beneath a hard and thick bed of kankar. Immediately upon getting through this kankar bed, water was seen to be coming into the well in great quantity when pumping was resorted to, and instead of being able to pump for half an hour only, at a time, as before the big boring was made, we could now not exhaust the supply of water by pumping 10 or 12 hours at a stretch. The well has since given a constant supply of 16,000 gallons per hour and has been very useful to the Farm. I am now carrying out a similar experimental boring in the west well and hope to be able later on to record an equal success with that as with the East one.

I am convinced that the majority of the *pucca* wells of this Province, constructed in districts where they can be sunk on to a good "mota" might just as easily be twelve-charsa as two-charsa wells. It is purely a matter of construction. The well cylinder needs to be sunk to the right level, well on to the clay or "mota" and the strongest springs beneath need to be tapped and a big supply of water will be ensured. There are inexhaustible supplies of water in the water-bearing strata of the subsoil of this Province and I am sure we are not drawing on these supplies to anything like the extent we might be. I believe that with a good sound system of well construction, eventually the whole of the province could not only be absolutely relieved from all fear of famine and scarcity in a year of drought, but could even be as prosperous, and as productive, practically all the province over, as some parts now are with a regular supply of water from Canals.

As regards Percolation wells—the bugbear of the department for the past twenty or thirty years—we seem at last to be well on the way towards the solution of the problem. A percolation well is one in a district where no "mota" or clay subsoil is encountered within a reasonable depth, the well cylinder thus having to rest in sand. Only a very limited yield of water can be got from such a well as the sand is continually on the flow into the well, filling it up, and even in a good many cases causing the well-cylinder to sink and crack. In past years a great number of arrangements for percolation wells have been tried. Various forms of weep-hole constructions either in the masonry cylinder or in a separate Iron Ring; the plan of making the well of very large diameter so as to get a big discharge area and thus not to exceed the critical velocity, the concreting of the bottom of the well and running down several pipes, with small holes in them beneath the concrete —these and a good many more methods were tried without any success.

Trials with satisfactory results have been made of different forms of tube wells. To illustrate what a tube-well is capable of, I will give a short description of a trial of one of the Brownlie type which I put down at Moradabad. The well was sunk to a total depth of 176 feet below ground level by the usual method of first sinking a large Casing Pipe (15" diameter) to that depth, putting down the Tube-Well within the Casing Pipe and then withdrawing the latter, leaving the Tube-Well in the ground. A Pump and Engine was installed and a constant supply of water of 18,000 gallons per hour was lifted without any appreciable lowering of the water-level in the well. I shall shortly be putting in a very much larger pump on this well as I am confident it will give double the yield it is now giving.

Tube-wells have also been put down at Nawabganj (Bareilly) and Balrampur, both of the Brownlie type and one of the same type is being put in at Fyzabad.

Further trials of both sorts of Tube Wells will be made in the coming year and results published in the next report. The year has thus been an extremely important one from both the "Spring" and the "Percolation" Well point of view. In both sorts of wells to be put down in the future we can get something like six times as much water as could be got under former ideas of construction.

5. *Demonstrations of pumping and other Machinery.*—This is a very important line of work and has been the means of enabling the zamindar and the cultivator to become acquainted with machinery to a certain extent. There are a large number of district Exhibitions held during the period from October to April and I endeavoured to get pumps and other machinery working for demonstration purposes at as many as possible of these Fairs during the past season. Machinery was thus sent to the Exibitions or Fairs at Moradabad, Etawah, Mainpuri, Unao, Hardoi, Sitapur, Bulandshahr, Aligarh, Muzaffarnagar, Saharanpur and Meerut. Great interest was taken in the plant at all these shows.

A pump and engine was installed on the bank of the river Gumti at Ujariaon about 4 miles east of Lucknow and was worked for two months as a demonstration of pumps actually at work irrigating crops. The set was put up a little too late in the season to be of maximum benefit to the rabi crops but still some very useful work was done in a season of drought. The villagers were impressed with the difference between the irrigated and the unirrigated crops and were very anxious to be taken within the area of the scheme. It was solely due to this demonstration of pumping that I was afterwards asked to instal much bigger and permanent pumps at Saroura, about 8 miles west of Lucknow.

A demonstration of pumping from a *pucca* well was given at Shahjahanpur farm on 25th April and from a tube-well at Moradabad on the 26th. The Director of the department was present at both places and a number of the more important *raises* and zamindars were invited to attend. The Shahjahanpur demonstration was poorly attended but that at Moradabad was a great success, a large number of the influential residents of the district being present and evincing great interest in the tube-well and the pumping machinery. As the result of this I have several demands for tube-wells for Moradabad district and am at present making small trial borings there to test the subsoil conditions.

Pumps are always set up ready to work at Cawnpore shops and are very frequently run as a demonstration, to visitors to Cawnpore, of the usefulness of such machinery.

6. *Well department boring plant.*—There was a bigger demand than usual for borers in most districts owing to the season being one of scarcity and there being a sudden rush for well making to save the crops. About a dozen new sheerlegs were made and sent out to extra borers put on. All the tools and plant of this branch have been kept in order by the Cawnpore shops, repairs done to broken tools, issues of pipes and new tools made as required and the borer's stock checked by the storekeeper as usual. Iron sheerlegs are not liked by the borers who complain of the heaviness of these in comparison with wooden ones and the consequent difficulty in transporting from one site to another. I have thus latterly been making the wooden pattern sheerlegs only.

7. *Work in connection with College.*—The gas and pumping plant has been kept in order at the college, repairs and renewals being undertaken as required. The classes for first, second and third year students in mechanical engineering, at the workshops, have frequently been without an instructor. I am away from Cawnpore a great deal and so also is my Chief Mechanical assistant, the workshop Superintendent. So many urgent erection jobs have been going on out of Cawnpore that it has not been possible always to leave an instructor, for the classes, in the station. When I get a bigger and better staff I can arrange a better system probably for this work. It is important that the students should have an elementary knowledge of practical mechanics and also know something of earth boring operations.

F. H. VICK,
Agricultural Engineer.

APPENDIX VIII.

Note on arboricultural operations during 1913-14.

During the year under report new trees were planted on 70 miles of provincial and 145 miles of local roads as compared respectively with 84 and 183 miles provided for in the working plans. Out of 145 miles planted on local roads 12 miles were planted by private individuals in Ballia (4 miles), Fyzabad (4 miles) Basti (3 miles) and Fatehpur (1 mile).

Working plans.—Most of the district boards adhered to their working plans but divergencies occurred in 12 districts on provincial, and 16 districts on local roads. Scarcity and want of sufficient rainfall chiefly account for the short plantings. In a few districts funds were, however, diverted to filling up gaps and in one district trees were planted in excess of the plan to make up for the deficiency of the last year's programme. Planting of unsuitable trees has practically ceased. A few *siris* trees were, however, planted on local roads in Meerut only.

Extensions of avenues.—During the year under report 44 miles of "paper avenues" have been removed from the records while 186 miles of recent planting have been added as "established."

Training class of supervisors.—The training class for supervisors opened as usual in April last at the Government Horticultural Gardens, Lucknow, and is being attended by ten students sent to it by district boards.

Financial results.—The receipts and expenditure on provincial roads fell from Rs. 35,140 and Rs. 79,730 to Rs. 25,236 and Rs. 76,289 respectively. The net cost to Government was thus Rs. 51,053 as compared with Rs. 44,590 in the preceding year. The expenditure on local roads was Rs. 1,15,149 or Rs. 4,768 more than in the preceding year. The receipts fell from Rs. 88,152 to Rs. 60,110. The fall in receipts in the case of both provincial and local roads resulted from drought and a decreased income from the sale of fallen trees.

REPORT

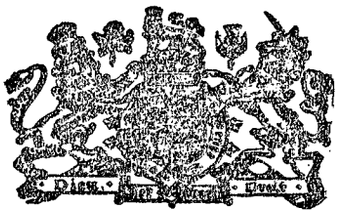
ON THE

Administration of the Department of Agriculture

OF THE

UNITED PROVINCES OF AGRA AND OUDH

FOR THE YEAR ENDING 30th JUNE 1915.



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Errata to the Report on the Administration of the Department of Agriculture of the United Provinces of Agra and Oudh for the year ending 30*th June* 1915.

Line 12 of para. 9 on page 2, *read* "in which all considerations other than profit-making" *for* "in which all other than profit-making."

Line 1 on page 9A, *read* "Demonstration" *for* "Demonstrations" before "farms."

Report on the Administration of the Department of Agriculture, United Provinces, for the year ending 30th June 1915.

No. $\frac{103}{\text{V—951A.}}$ OF 1915.

FROM

THE HON'BLE MR. H. R. C. HAILEY, I.C.S.,
DIRECTOR OF LAND RECORDS AND AGRICULTURE,
UNITED PROVINCES,

TO

THE CHIEF SECRETARY TO GOVERNMENT,
UNITED PROVINCES, REVENUE DEPARTMENT.

Dated Lucknow, the 25th of October 1915.

SIR,

I HAVE the honour to submit the report on the administration of the department of Agriculture for the year ending 30th June 1915.

The method adopted in last year's report showing details of the working of different sections in the appendix has been continued.

CHAPTER I.

ADMINISTRATION.

Officers of the staff.

2. I remained in charge of the department throughout the year. Mr. H. M. Leake, Economic Botanist, held charge of his office for the whole year. He also assumed the charge of the office of the Principal of the Agricultural College with effect from 1st October 1914, in addition to his own duties, on the transfer of Mr. A. W. Fremantle to special duty in connection with the investigation on the reclamation of ravine lands in Bundelkhand and the Agra and Muttra districts. Mr. B. C. Burt was in charge of the Central circle throughout the year and also officiated as Director of Industries until the appointment of a permanent incumbent on 1st January 1915. Dr. A. E. Parr and Mr. L. C. Sharma held charge of the Western and Eastern circles respectively throughout the year. Mr. G. Clarke, Agricultural Chemist, was in charge of his office throughout the year. Mr. A. Wilson held the post of the Assistant Economic Botanist for the whole year. The appointment of a third Deputy Director of Agriculture was sanctioned at the end of the year 1913, and Mr. W. N. Harvey took charge of the post on 3rd December 1914.

3. Mr. F. H. Vick, the Agricultural Engineer, remained in charge of his office throughout the year.

4. Khan Bahadur Mir Saiyid Husain, my Personal Assistant, returned from two months' privilege leave on 22nd July 1914 and remained in charge of his office till the end of the year. M. Abdul Aziz II, who acted for him, went back to his post as Principal of Kanungo Training School, Cawnpore.

5. M. Akhtar Mohammad Khan, Deputy Collector, was attached to the department for investigation of the commercial prospects of sericulture in these provinces.

6. Mr. W. Hulme, the Sugar Engineer, returned from England on 18th October 1914 and took charge of his duties. He went back home on 2nd April 1915, after completing the season's work. The term of his appointment will be completed in April next, and it has not yet been decided whether his services will be retained for some more years.

Development.

7. The year has not been a favourable one for the development of some of the principal branches of work on which the department has been engaged. The rapid fall in the prices of cotton, following the opening of the war, led to a great restriction of sowings, and interfered with the schemes which had been proceeded with for some years past for the extension of particular types. Many of the cultivators who had been growing these types for some years past preferred to put down indigo, or food grains, in preference to cotton. As was pointed out in last year's report, as a result of demonstrations of the practical value of power pumping, considerable interest had been aroused in the subject. The interest is maintained, but there was some reluctance to embark on any new venture involving an outlay somewhat heavy in proportion to the means of many landholders. Great difficulties and delays, too, were experienced in procuring the plant for carrying out the orders that were received. This scarcity of plant and the higher prices made it necessary to curtail the work of the boring department and reduce the staff.

8. In more general matters, some of the projects which had been entered into with district boards for opening district farms have been temporarily hung up, as they would involve larger increases in the permanent staff of the department and heavier contributions than can be reasonably asked for at the present juncture. One farm subsidised by the district board has, however, been opened in the Hardoi district. The loss suffered by cultivators of the western districts, owing to the drop in cotton prices, affected the finances of the co-operative societies of which they were members. The latter had necessarily to proceed cautiously with some schemes for co-operation with the Agricultural department for establishing seed dépôts and undertaking seed distribution. Moreover, as it was intended to specialise in cotton seed, for which the demand had declined, the opportunity was unfavourable for undertaking seed distribution on a large scale. On the other hand any prospect of an early termination of hostilities must, owing to the limited sowings, create a strong demand for seed, and operations can then be started with better hope of permanent success. In one direction, however, considerable progress has been made. Some of the large landlords in Oudh have shown keen interest in agricultural improvement and have opened farms on their estates, primarily with the object of providing seed of improved varieties of crops to their tenants. This new development is particularly useful since, owing to the small size of the farms of the department and the complexity of the transactions involved in buying any appreciable quantity of seed from a number of small cultivators, the provision of seed presents one of the chief difficulties of the department. As these farms increase in usefulness they will relieve the officers of the department of a good deal of the troublesome work of supplying seed, which at present takes up an unduly large proportion of their time. In addition, a farm of some size has been made over to the department to show that higher profits can be realised from improved methods of cultivation than by existing methods. It has already been shown that heavy profits can be realised by growing the best classes of wheat and rice on a large scale. A full account of the new farms opened in the Eastern circle is given in appendix no. III.

9. In this connection a reference may not be out of place to a point not unfrequently raised in connection with the administration of the department of these provinces. Criticism is directed against the receipts from the Government farms, which, it is urged, are not on a scale to inspire confidence in the methods adopted. Some remarks by Mr. H. M. Leake in appendix V on this subject apply closely to other farms. They are not of an economic size and are not managed with a view to showing good financial results. They would in fact fail to fulfil their purpose, as largely experimental farms, if they were so managed. If only the crops already known to be the most profitable were sown, it is difficult to see how the agriculture of the provinces would be in any way benefited. It is, therefore, very desirable that the department should have some land under its management, such as that mentioned above, in which all other than profit-making may be disregarded.

10. The appointment of a third Deputy Director has permitted of steps being taken for the opening of a farm in the Gorakhpur district, which will form the headquarters of the new South-Eastern circle. It must, however, be some time

before the new circle is fully organized, since the staff of the existing circles is too small for men to be spared for it. When constituted some reduction will be possible in the size of the other circles which are now too large to be properly looked after.

CHAPTER II.

Agricultural Education.

Agricultural College.

11. The reorganization of the Agricultural College was completed during the year, and a start made with the new courses from October last, when Mr. H. M. Leake took charge. There are now two courses—a vernacular of two years, and a higher diploma course of four years. The two are distinct, with different objects in view, and it is not intended that one should form a stepping-stone to the other. The qualifications are different and it has not been thought desirable to burden the two-year men with elementary instruction in sciences with which they will not proceed further. The former of the two is designed for men who desire a practical knowledge of agriculture with a view to farming their own land, or entering the lower ranks of the agricultural service. It is hoped also to attract sons of the larger landlords interested in the improvement of their estates. The second course is for those desiring to take up a wider study of agriculture and connected sciences. The higher ranks of the agricultural service will be recruited from those who have obtained their diploma, and it is not expected that the numbers taking this course will be large. So far both courses have filled satisfactorily.

12. In order to conduct this extended system of agricultural education it will be necessary to enlarge the staff and increase the teaching facilities. The separate courses call for a larger number of instructors, and the present farm is far too small for teaching practical agriculture to the now increased number of students. Adequate means should also be provided for giving instruction in dairying and some branches of mechanical engineering.

Horticultural education.

13. The overseer class at Saharanpur is now composed of four students only, no additional students being taken during the year.

This class has been in existence since 1908, but must now be closed. A sufficient number of overseer gardeners for vacancies likely to occur in these provinces have been secured, while hardly any students have been attracted from outside. It was hoped that the very favourable situation of Saharanpur would commend these gardens as a centre for training residents in India for the gardening profession ; and there can be few places in India capable of producing a greater variety of fruit and flowers. This hope has not been realised, and with the single exception of a student from the Central Provinces, no one else has come for a course of training. The school, however, so far as these provinces are concerned, may be said to have fulfilled its purpose. It has provided men to take charge of the public gardens at Cawnpore—thereby setting free a European-trained gardener for transfer elsewhere—Fyzabad and Meerut ; while one overseer has been temporarily lent for the Bankipur gardens. Assistants have also been provided for the larger gardens, who have formed a reserve for leave vacancies.

14. There is clearly no lack of material for this class of work in India. Applications have been in excess of vacancies ; and the majority of those selected have shown a liking and aptitude for gardening work. There is every reason to believe that the course of training given by Mr. A. C. Hartless has been a sound one ; and the men he has trained will prove a useful addition to the department. Assuming, as seems not improbable, there is an extension of the fruit-growing industry in the Kumaun hills, the school might be re-opened on somewhat different lines.

15. Both the chaudhri and mali classes continued at the Saharanpur and Lucknow gardens. Both classes are full and there is a fair demand for trained men. As usual, the demand for malis is much in excess of the number available.

CHAPTER III.

Research and Experiments.

Cotton.

16. The investigations carried on by the Economic Botanist in connection with cotton are described in appendix V. One of his selected varieties was tried on a field scale in Bundelkhand; but the year was unfavourable, as the Canal department could not supply water for early sowings and the plants, which were sown late, were exposed to continuous rainfall. Trials are being continued.

17. In the Western and Central circles comparison of various varieties continued; but both these circles are engaged in putting out selected types and there was necessarily less experimental work done. The Cawnpore American cotton is somewhat mixed, and selection work is being carried in the Central circle to secure a more uniform type and eliminate the plants with a low ginning percentage.

Sugar.

18. Owing partly to the later opening of farms in the sugar-growing tracts, and partly to the natural difficulties to be encountered, the work on cane is not so far advanced as that on cotton.

On the cultural side, experimental work is being carried on at the Shahjahanpur research farm, both on indigenous canes and foreign canes likely to prove suitable to the conditions of these provinces. A full account of some of the results attained is given in appendix VI in Mr. G. Clarke's note on the working of the farm. The most promising results have been obtained from a medium-sized cane, known as Java 33 which is being tried in different parts of the provinces and appears to possess qualities fitting it for general cultivation. The indigenous canes are gradually being sorted out, and a selection made of those most suitable for particular localities. Of these Saretha appears to be the most popular on account of its hardiness and heavy yield; and its cultivation is extending somewhat rapidly in the Western and Eastern circles. The opening of the Gorakhpur farm will permit of similar work being done in that part of the provinces which possesses climatic conditions distinguishing it somewhat markedly from the western districts.

19. The improvement of the cane crop in these provinces is likely to be a slow matter. The mere substitution of one variety for another, without any alteration in methods of cultivation, will not effect it. It is an unfortunate fact that cane in ordinary years is not a very profitable crop; and the manufactured article, whether *gur* or sugar, is liable to periodical depression of prices. The wasteful khandsari system flourished only on the indebtedness of the cultivator, who actually received ruinously small prices for his produce. The natural tendency therefore has been to reduce expenses to a minimum, rather than to put more money into the crop to improve the outturn and quality. The best hope of raising the standard of cultivation lies in co-operation between growers and owners of modern sugar factories, who are concerned in securing a steady supply of good quality cane.

20. The provision of one of the main requisites for better crops, viz. water, can often be arranged for without great expense; and experience shows that, once assured of this, the cultivator will often be willing to spend money on manures. It is therefore a promising sign that both the Rosa and Cawnpore sugar factories have interested themselves in securing good seed for their growers and afforded them assistance in putting it down. Both the Rosa and Pilibhit factories are making arrangements for supplying water to a certain number of their cane cultivators.

21. Another promising feature is the rapid expansion of cane-growing for eating purposes. It is estimated that there are now some 60,000 acres under eating canes which are either thick, or of medium thickness. Formerly canes originally imported from Bombay or Madras were almost exclusively grown; but of recent years foreign canes, procured from the Government farms, particularly Ashy Mauritius, seem to have become equally popular. The profits from these canes are very large, and a good deal of money is spent on manuring and watering. It would probably not pay to spend as much on cane for *gur* manufacture—at any rate when that article is at normal prices—but in course of time the superior

cultivation of these eating canes is likely to influence cane-growing generally; and meanwhile they will pave the way for the introduction of better kinds of cane.

22. The mechanical problem is being attacked in two directions. As noted in last year's report, Mr. W. Hulme, the sugar engineer, brought out a plant, which was designed for use by small capitalists, and would turn out either *gur* or sugar. Last season it was used entirely for the latter and produced a very fair quality of sugar. As Mr. W. Hulme is greatly impressed with the necessity of the introduction of more efficient crushing plant, the mill has been made a special feature of the design. It developed however certain defects, which, owing to the occupation of the makers on other work, could not be remedied. The defective parts have now been replaced and the plant will be given a fuller trial during the coming season. One very satisfactory feature was the economical working; no fuel in addition to the megass being required. It is not of course pretended that a plant of this nature can compete in efficient, or economical working, with a fully equipped modern factory. But it should suit the smaller man with a limited amount of capital, who can command a moderate area of cane. The present methods are so extraordinarily slow that even when the prospects of sugar-making are favourable, as in the present year, substantial zamindars engaged in the industry hesitate to put down more cane owing to the impossibility of dealing with it. Its higher efficiency as compared with bullock mills and corresponding accessories should go a long way to meet initial cost. Some fuller details of the plant and the objects in view in designing it were given by Mr. W. Hulme in an article appearing in the January number of the *Imperial Agricultural Journal.*

23. The other experiments which are being conducted by Mr. G. Clarke with the aid of Mr. F. H. Vick, the Agricultural Engineer, are directed to turn out a suitable small-power mill capable of being worked by the oil engines ordinarily employed by cultivators and small zamindars for pumping purposes. The Agricultural Adviser to the Government of India has kindly made a grant for the experiments. The importance of the matter can be best gauged from the numerous applications received for some form of plant of this nature; the writers all making practically the same remarks, either that they were unable to put down their sugarcane owing to bullocks being employed on cane-crushing, or that they could not get through their crushing before the *rabi* cutting began. None of the designs which have yet come under notice seem recommendable, or have any superiority over the bullock mill, except in point of speed. The latter, as has been pointed out by Mr. G. Clarke, though very slow and expensive, under the most favourable conditions of working, is capable of giving a fair extraction, and it would be doubtful policy to offer anything inferior in this respect.

Wheat.

24. As Pusa wheat no. 12 has proved most suitable for the greater part of the provinces and has been definitely adopted for distribution, experimental work was mainly confined to testing types for particular tracts, such as Bundelkhand and parts of the submontane districts. In the latter the prejudice, owing to the relatively high damage from birds and animals, against a beardless wheat is strong; and some other form of wheat will probably be selected. In Bundelkhand, where an early ripening wheat not demanding a great deal of water is required, Pusa no. 4 has been tried with some success. The future problem of wheat is now mainly connected with the supply of a sufficient quantity of seed of the selected type.

Other crops.

25. Two other crops which have engaged attention this year are barley and poppy. Prior to the scarcity year of 1913-14, the former was shipped in large quantities to Europe. It was, however, reported that, while some of the Indian barleys proved quite satisfactory for malting, other shipments contained a large percentage of grains which would not germinate, sometimes amounting to 10 to 20 per cent. It was noticed that the latest shipments usually exhibited the defect, and it was suggested that it might be accounted for by the methods of storage adopted during the rainy season. The experiments undertaken by the Economic Botanist went to show that the failure to germinate was probably due to exposure of the grain to excess humidity at high temperature; and further enquiry is directed to ascertaining the limits of safety. The results will be published in due course.

26. The poppy crop had not previously been dealt with by the Agricultural department, but last year, at the request of the Opium Agent, Mr. H. M. Leake undertook some inquiries with a view to ascertaining the causes of a somewhat widespread disease which was resulting in a decline of the yield. The different varieties of poppy grown in the provinces have not been systematically studied and classified; and the enquiry extended somewhat beyond its original scope of investigating the disease and isolating, if possible, resistant types. The outbreak of the war with Turkey and the closing of the Smyrna market led to a demand for opium with a higher morphine content than that ordinarily produced in these provinces; and the Local Government have now directed that the subject shall be investigated. Some preliminary steps have been taken to procure poppy seed from Persia. The problem is a somewhat complicated one and involves other than purely botanical questions; but, if it can be successfully solved, it opens up prospects of a new and profitable industry. The wide range of research work undertaken by the Economic Botanist, in addition to his college duties, will necessitate some permanent assistance being given him.

27. There is a good deal of experimental work carried on at the farms on different crops, as may be seen from the reports, with a view to testing varieties and ascertaining their suitability to different localities. The importance of the latter point is sometimes underestimated, but experience has shown that in a country of wide climatic variations, a type which has proved satisfactory in one part of a circle will not necessarily suit another. Hence the necessity for subsidiary farms, which are as much experimental as for purposes of demonstration. Among other crops likely to assume greater prominence in the future is tobacco, owing to the spread of cigarette factories. There has been a demand for tobaccos, specially suited for this purpose, and experiments are being made with seed obtained from Pusa. It has also been shown that flax of a fair quality which has been well reported on by an English firm to whom it was submitted for opinion can be grown without difficulty, and gives a good outturn of straw. There should be openings for this crop in districts with no prominent commercial crop, if capital were forthcoming to put down the necessary plant for retting and scutching.

Green manuring.

28. There are few more important problems confronting the Agricultural department than that of placing before the cultivators either manurial substances, or some methods of enriching the soil, which are not beyond their means. A great deal of attention has been paid to green manuring; but it is clearly a subject which needs more investigation, as the results remain uncertain. The growing intensiveness of cultivation has led to a demand for manures on the part of the more enterprising cultivators; those rich in organic matter, such as castor-cake, being especially favoured. At present a considerable proportion of that produced in the provinces is exported, and the small man often finds it difficult to procure it at reasonable prices. The cultivators of certain localities are now being encouraged to put down a larger area of the plant as a field border; and it is hoped to make arrangements for crushing it locally; returning them, the oil and cake, minus reasonable cost of crushing. This question of the provision of manures is one that might well be taken up by the co-operative societies, as soon as they are in a position to enter on supply transactions.

Threshers and bhusa-makers.

29. There are now four combined threshers and bhusa-makers working at the different farms. They may be said to have passed the experimental stage and definitely proved their usefulness. Indeed, it would be impossible to carry on the work of the farms where large areas of wheat are grown for seed without them. The spread of large seed farms in Oudh will necessitate the extended employment of mechanical threshing, since the grain would not be threshed by bullock-treading before the rains. The tractor plough brought out for eradicating the *baisurai* weed has proved less successful. The objection to the removal of boundary lines is great, and the cultivators seem to prefer the weed to the possible encroachments of their neighbours. It is therefore being used to break up land for cultivation in the Muttra district. A motor plough has been brought out and is being tried for eradicating *kans* in Bundelkhand.

30. Sheep-breeding experiments were carried on at some of the farms in conjunction with the Civil Veterinary department. A considerable amount of experience has now been gained as to the result of crossing with merino rams, and of the localities where the half-bred is likely to do well. It is proposed to establish a demonstration farm where the results can be seen on a large scale. The general results so far attained have been set out in a note issued on the subject by the Superintendent, Civil Veterinary department.

Sheep-breeding.

CHAPTER IV.

ASSISTANCE TO THE PUBLIC.

31. As in previous years, the provision of seed took up most of the time of the officers of the department, and is undoubtedly one of the forms of assistance most appreciated. The demand for seed for particular crops varies very much with the season ; and it is not always possible to foresee what form it will take. A big organisation has now been built up for supplying cotton seed ; but, owing to the peculiar circumstances of the year, the demand was comparatively small. On the other hand the demand for indigo seed, for which the department was not prepared, was very great and that for wheat was on a unprecedented scale. The latter was due to actual scarcity of seed following on a poor harvest. Cane was in request, owing to promise of higher prices for *gur*, but it is a most difficult demand to satisfy, as some unfortunate experiences have shown. The despatch of cane by rail is attended by considerable risk ; a very appreciable proportion dying on the journey. The demand can only be met by small farms in the most important cane-growing districts.

Distribution of seed.

32. The types of cotton which were distributed were Aligarh white-flowered in the western and parts of the central districts, and Cawnpore-American in the districts round Cawnpore. As a good deal of the former is now sown from the cultivators' own seed, no very definite figures can be given of the area under this crop. In spite, however, of the unpopularity of cotton this year and the fact that many of the best cultivators were sowing indigo, seed for over 10,000 acres was bought from the farms. The Cawnpore-American crop last season amounted to 450 bales, which was sold at a price permitting payment of a premium of 25 to 40 per cent. over *deshi kapas*, according to quality. This year arrangements have been made with the Muir Mills for the disposal of what will probably prove to be the bulk of the crop ; the high prices of indigo and rice having attracted many of the former growers. The future of this crop must depend on the extent of the demand for a long-staple cotton from the Cawnpore Mills, which is likely to increase with the steady decline in village weaving and smaller market for yarns. In the Eastern circle cotton-growing is at a considerable discount ; but some of the types now being tried, particularly a yellow-flowered selection, seem likely to become popular, as interest revives.

Cotton.

33. There was a keen demand for seed of Pusa wheat no. 12 in all circles. Arrangements were made for securing a consignment from Behar, but, owing to an indifferent harvest, the amount actually received was less than anticipated ; and a large number of orders for the seed could not be filled. In the coming *rabi* a much larger stock will be available ; as a number of private farms have grown the wheat for seed purposes and some of the co-operative societies have arranged to purchase back seed from growers. It is hoped that enough will be grown for an experimental shipment in bulk in order to test its value on the English market ; the arrangements for which are being made by the Imperial Economic Botanist.

34. Seed of a number of other crops was distributed from the different farms. These vary with the locality. In the western districts, the demand for canes is considerable, and the Western circle reports distribution of the Saretha variety on a large scale. In the Eastern circle the demand is for rice, barley, and peas. Ground-nuts are now fully established, and the demand for seed has somewhat fallen off.

35. Arrangements are now made at all farms and some of the co-operative societies dépôts for sale of implements. Ploughs continue most in demand. The practice has been

Sale of implements.

introduced of awarding implements, instead of money prizes, at the agricultural exhibitions. Some attempts were made during the year to secure an efficient and cheap substitute for leathern well buckets. Interest in the subject has somewhat declined, owing to a fall in prices of country leather, and none of the proposed substitutes proved very satisfactory.

Silos.

36. The silo put down at the co-operative society's dairy, Lucknow, gave a fodder which was readily eaten by the cattle. Owing to the high water level and sandy nature of the subsoil, it had to be built of masonry and was on too small a scale to be of much practical utility. It will probably prove more economical to build above ground in many parts of the provinces.

Well-boring.

37. The boring department has undergone some reorganization during the year. A certain number of borers have been deputed for training in tube well-boring; and are now either learning this branch of work, or employed in making trial borings to test the suitability of the site for sinking these wells.

In addition, it has been decided to remove borers from the submontane districts and concentrate work for well improvement in districts where this work has been shown to be simpler and more likely to prove successful. A great deal of time and labour has been wasted in these submontane districts, with little more than disappointment to the well-owners. Pockets of clay suitable for well-foundation are met with at very irregular intervals throughout this tract of country, but the conditions of the subsoil are usually not such that the well can be improved by further boring. The great bulk of the wells are of the percolation type, and, so far as present experience goes, the only form of well likely to give increased supplies, is that of a tube with some form of strainer. As water is usually met with a few feet from the surface and the substratum mainly sand, it should be possible before long to put these wells down at a cheaper rate than at present. This is a question to which the Agricultural Engineer is devoting his attention. Meanwhile in order not to encourage the hope that any good results are likely to follow from ordinary borings in such areas, the borers are being withdrawn.

There are other parts of the provinces in which the subsoil consists of belts of clay and water-bearing sand. In these areas the borers have done good work; there is a keen demand for their services and, as their footage earnings show, work is simple and presents no difficulties. There remains a third form of substratum, chiefly met within the western districts and Bundelkhand, consisting of deep beds of hard clay mixed with *kankar* for which our present form of hand plant is quite unsuited. Either it must be considerably modified; or, possibly, a solution will be found in the mechanical boring plant now being brought out. In the end therefore the boring operations as at present conducted will be confined to a clearly defined area and can be carried on with a much smaller staff.

38. The total number of borings of existing wells amounted to 1,185 as compared with 1,642 in the previous year, the falling-off in numbers being due to scarcity of plant and reduction of staff. The returns by districts clearly bear out the futility of continuing work in certain areas. Thus in the Lucknow and Rai Bareli districts, where boring presents no difficulties, the number of wells in which boring was undertaken were 100 and 119 respectively, while in the adjoining districts of Sitapur and Kheri they were 4 and 7. Similarly in Mainpuri and Etah they were 48 and 98, and in Agra and Muttra they were 11 and 9. Matters were thus largely settling themselves, past experience having shown zamindars the measure of success likely to be attained, and this experience is reflected in the applications submitted. In a certain number of the districts borers remained idle for months at a time, and it is a waste of money retaining them.

Agricultural Engineering.

39. The main features of the work have been the introduction (1) of tube wells, (2) of mechanical power for use in existing wells and (3) installing pumping schemes in tanks and small rivers.

Of the suitability of the first-named for many parts of these provinces, there is no longer any doubt, and they have been widely adopted by the Sanitary Engineering department for providing water for the larger towns. Though, as noted by Mr. F. H. Vick in appendix VII, they have so far proved a success

wherever tried, their main utility is likely to be found in the percolation areas, where ordinary wells yield a wholly insufficient supply for irrigation purposes, and can only be worked for short periods. Their extended use in a district like Gorakhpur might profoundly affect the conditions under which the two principal crops—rice and cane—are now grown. Several of our farms have been equipped with these wells, and they are about to be installed in the Government Gardens at Lucknow and Saharanpur. Other places in which they have been put down for the protection of precarious areas are in a part of the Unao district, where the water level has sunk considerably; in the Muttra district, and the *bhur* tract of the Budaun district. These wells have been sunk experimentally with the aid of grants from Government to obtain more definite information as to the area that can be protected, costs of running, and how far these and initial expenses can be recouped by sale of water. There are a number of orders on hand from Court of Wards and other estates, the completion of which has been delayed by difficulties in procuring plant from Europe. A power boring plant is on its way from Australia, which should expedite the sinking of these wells. Of the projects for irrigation from small rivers, one of the most promising is that undertaken on behalf of a co-operative society for raising water from the Gumti. It is hoped to irrigate some 400 acres of rather precarious land, and to control the cultivation by introducing more paying crops.

40. Power plant for wells is extending mainly in the Bulandshahr and adjoining districts, where a local company, working with the circle officers, has been formed for bringing out oil engines, and installing them. A school has been started for training drivers. Conditions in this area are favourable for the introduction of power plant, as there are numerous existing wells which, with inconsiderable expenditure on boring, are capable of giving practically unlimited supplies of water. There is much canal irrigation in this part of the country, and the advantages of getting water on payment and saving expensive bullock labour are fully appreciated by the cultivators of villages outside the canal radius. The introduction of power plant offers the solution of other problems than protection from drought. The owners of the oil engines find it profitable to use them in off-seasons for other purposes, such as ginning; and Dr. Parr is organizing seed farms in those villages the owners of which will undertake the growing and distribution of seed.

CHAPTER V.

MISCELLANEOUS.

Co-operative societies.

41. In spite of the unfavourable conditions of the year, some further progress was made in developing relations with the co-operative societies. In the cotton-growing areas their activities for the reasons before stated were somewhat at a standstill; but in the central circle a certain number engaged on the distribution of wheat seed. Two of these banks have their own seed stores and have worked out definite schemes for future operations. Another society in the Eastern circle is arranging to take over a seed dépôt. Some interesting schemes for irrigation on co-operative principles are being tried. The first, viz., that of the Kunwar co-operative society, for pumping water from the Gumti has already been mentioned. The manager of the central society, who has interested himself greatly in the scheme, feels convinced that, even if it does not prove directly profitable, it will ultimately strengthen the financial position of the society by obviating the possibilities of crop failures. The second scheme is for a portable plant for working wells in the Bulandshahr district, which will be in operation next *rabi*, and the last for a tube well in the Hardoi district. In Mainpuri district the Agricultural Association have opened a demonstration farm and have registered a separate society for seed-supply. Other schemes for protecting the land of societies situated in precarious areas are under consideration with the Registrar, Co-operative Societies.

Seed farms.

42. One of the needs of the department is larger farms for seed-production, and for maintaining the purity of particular types. This applies in particular to wheat, which for many reasons is found difficult to buy back. The organization required for buying back any appreciable quantity from small cultivators is so extensive that it would be more

economical for the department to grow larger quantities. It is a waste of effort to put men who have been through a college education on the seed buying business; yet, under the present system, it is unavoidable if the demand is to be met, and any rapid progress with the introduction of selected varieties, such as Pusa wheat, is to be made. Oudh, with its large estates, can possibly look after itself; but there should be seed farms of some size in the other circles. There are parts of the provinces, such as Muttra, where derelict land can be obtained at no great cost and made suitable for the purpose.

Agricultural exhibitions.

43. Some seventeen agricultural exhibitions were held in different parts of the provinces. They were well attended and some of the exhibits were very good. The largest interest attaches to any form of agricultural machinery which always forms an attraction to agriculturists. A grant-in-aid of Rs. 3,500 was made by Government for prizes for agricultural and industrial exhibits, which was distributed among the committees. A few of the co-operative societies now hold exhibitions of their own; and these provide an opportunity for a meeting of co-operators and the discussion of matters connected with the working of the societies. There is little doubt of the popularity of these exhibitions, and their usefulness is being further increased by opening demonstration farms near the grounds.

Fieldmen.

44. During the year sanction was given by Government for establishing a service of fieldmen on graded pay. As has been frequently pointed out this class of men are cheaper and, for certain branches of work, more useful than college trained overseers. Some of the best of them are pensioners from Jat regiments, who are admirable at controlling labour and take the keenest interest in farm work. Several of the smaller farms have been made over entirely to their charge. Training is also being given in the Eastern circle to fieldmen for the private farms.

Receipts.

45. Receipts for the financial year amounted to Rs. 77,344 as compared with Rs. 66,264 in the previous year. They would have been larger but for the great drop in price of cotton, which is one of the principal crops grown. The receipts from sale of wheat, which were better than usual, were not included in the figures of the year.

General.

46. It has been necessary to dwell with some emphasis on the fact that much of the time of the Agricultural department is taken up with the provisions of the first essentials for agriculture, viz., seed and water; and it is further indicated that provision must be made in the future for manures. In western countries there are usually private agencies ready to undertake such work on lines dictated by the agricultural expert. The constant need for larger staff and more money arises from the fact that the officers of the Agricultural department are not merely advisers or demonstrators, but have also to undertake the functions of supply agencies. These functions are not sought after; but merely assumed because advice, unaccompanied by means of carrying it out, is likely to prove profitless. Like most other businesses, in their early stages these are not always directly remunerative. There are satisfactory indications to which allusion has been made, that a certain number of private individuals are prepared to assist, but with justice it cannot be said that this aid has been very appreciable, and it will be a long time before the department can divest itself of these duties which are meanwhile increasing in urgency. Gradually, as some of these operations, such as seed dépôts, are placed on a paying basis, they can be made over to private agencies. There is at present no reason why much of the boring work in areas where success has been proved should not be made over to private firms. So long, however, as the work of the Agricultural department consists largely in supplying agriculturists with the means of improving their agriculture, it cannot be made too clear that its activities and progress will be largely measured by the amount of financial assistance afforded.

Agricultural publications.

47. The following English bulletins were issued during the year under report:—

Bulletin no. 32.—Note on the irrigation of wells in the Jaunpur district by A. C. Walker, Collector of Jaunpur.

Bulletin no. 33.—Note on the level of the water in the subsoil of the Gangetic plain by E. A. Molony, Commissioner of the Agra division.

48. A number of vernacular pamphlets and scientific papers were issued which are detailed in appendices II, V and VI.

The cattle census of the United Provinces was taken and a note on the subject published.

I have the honour to be,

SIR,

Your most obedient servant,

H. R. C. HAILEY,

Director.

APPENDICES.

APPENDIX I.

Report on the administration of the Western circle of the department of Agriculture, United Provinces, for 1914-15 *by* DR. A. E. PARR, B.Sc., PH.D., M.A. *and* M.S. *in Agriculture, Deputy Director of Agriculture.*

I held charge of the circle for the whole of the year. This circle has now agricultural stations in the following districts :—

1. Aligarh.
2. Bareilly.
3. Agra.
4. Muttra.
5. Bulandshahr.
6. Saharanpur.

District work.—The demand for white-flowered cotton seed was small as compared with previous years. The total amount sold was 75,600 pounds. The diminution in demand corresponds closely with the decrease in the area sown in the irrigated districts and does not indicate any comparative decline in the popularity of this variety of cotton. Similarly Buri cotton has not increased its area much this year. This is due partly to the decline in prices in cotton and also to the fact that the tract where Buri was doing best has grown a considerable area of indigo this year instead of cotton.

Sugarcane.—A total of 308,900 canes were distributed during the year, chiefly of the Saretha variety. Some medium thick canes are being grown in the Bulandshahr district and at present look very promising.

Wheat.—Pusa 12 wheat is now in great demand. About a thousand maunds are available for distribution in the coming rabi. Almost all this has been already sold. Arrangements are being made to distribute it chiefly in the Bulandshahr and Saharanpur districts. These will then form two convenient centres for buying and wider distribution next year. Muzaffarnagar wheat is being distributed in other tracts. Groundnuts have now established themselves almost everywhere and are doing well. Little need be done in this matter until still better varieteis have been obtained.

In the year under report the pumping installations mentioned in the last report have had a fair trial and have proved a great success. The demand is increasing and indents come in quicker than the staff available can cope with them. The mere setting up of the installations is a minor part of the work. The training of the men to drive them and the supervision of the engines for the first few months after installation take up a lot of time and personal attention. Gradually a large number of skilled drivers and supervising mistries are being turned out and these are now practically the only limiting factors to the number of sets which can be disposed of. A beginning is now being made in the organisation of seed farms around these pumping installations. They should form suitable centres for growing improved varieties of crops and for distribution of seed. Court of Wards in Aligarh and Bulandshahr are now going in for pumping installations. The activities of co-operative credit societies during the year call for no special remarks.

Agricultural shows.—During the year under report special attention was devoted to the Aligarh and Bulandshahr shows only.

Experimental work at Aligarh.—At Aligarh cotton, wheat, sugarcane, maize, and groundnuts are the chief crops under investigation. Several varieties of cotton received from the Economic Botanist are under trial, also some varieties of American and selected *desi* cottons.

Several varieties of wheat are being tried on the farm and so far Muzaffarnagar and Pusa 12 have proved the best.

A large number of varieties of groundnuts and sugarcane are being tested. Some of the thicker canes grown this year show promise of success particularly Uba and Java 33. The latter was supplied by the Agricultural chemist. It has been grown on the Aligarh and Bulandshahr farms and also with a zamindar in the Bulandshahr district in comparison with other canes. Of all the thick canes tried, at present Java 33 and Uba look far the most promising.

The Aligarh farm now has the following things to recommend all of which have been proved a success in the villages :—

1. Ordinary white-flowered cotton.
2. Buri cotton (for certain tracts).
3. Pusa 12 wheat.
4. Muzaffarnagar wheat.
5. Big Japanese groundnuts.
6. Saretha cane.
7. Some varieties of thick cane for chewing purposes.

The farm is also the centre for the supply and supervision of the previously mentioned pumping installations in the Aligarh and Etah districts.

Bareilly Farm.

The chief experiments are :—

1. Comparison of the various varieties of thick and thin sugarcane.
2. Trials of various varieties of wheat, rice, cotton, arhar, groundnuts, gram, soybeans, and maize.
3. Trial of various methods of growing sugarcane.

So far experiments have shown that the following things can be recommended :—

1. Striped Mauritius cane for chewing purposes.
2. Pusa 12 and Muzaffarnagar wheat.
3. Early ripening arhar.
4. Some varieties of thin cane.

The Muttra farm has now demonstrated the value of the following things and distribution is going on :—

1. Pusa 12 wheat.
2. A particular type of white-flowered cotton.
3. Saretha sugarcane.
4. Groundnuts.

The Agra farm is a centre for the distribution of the following things :—

1. Ordinary white-flowered cotton.
2. Groundnuts.
3. Pusa 12 wheat.

From the Bulandshahr farm the following things are in demand :—

1. Bahrampur cotton.
2. Pusa 12 wheat.
3. Groundnuts.
4. Saretha cane.
5. Various kinds of thick cane.
6. Oil engines and pumps.

Saharanpur farm has already proved the value of Pusa 12 wheat and it should become an important centre for the distribution of this variety.

Other investigations which are going on are the following :—

1. A steam ploughing set is being worked in the Muttra district. It seems probable that this may be of value in breaking up and clearing some of the weed-infested land which has gone out of cultivation.
2. Sheep-breeding experiments in co-operation with the Civil Veterinary department are being conducted at Gursikran.
3. An attempt is being made to work out a portable pumping set which would be of use to the various members of a village co-operative society where wells are the source of irrigation.
4. Experiments are being made at Pali in the Bulandshahr district to see to what extent the expense of a masonry cylinder can be avoided when a well is being built for the purpose of using an oil engine for pumping. It seems probable that several hundreds of rupees can be saved on each well and this will go a long way towards buying the pumping installation.

A preliminary investigation has been begun to see if anything can be done in the tracts where the water level is very deep, in the way of small power pumps.

A. E. PARR,
Deputy Director of Agriculture.

APPENDIX II.

Report on the administration of the Central circle of the department of the Agriculture, United Provinces, for 1914-15 *by* MR. B. C. BURT, B.Sc., *Deputy Director of Agriculture.*

Staff.—I was in charge of the circle throughout the year and also officiated as Director of Industries until the appointment of a permanent incumbent of that post on the 1st January.

No alterations were made in the staff of the circle during the year except the appointment of more fieldmen for practical farm work, a definite cadre for whom has now been sanctioned. The men appointed are all good practical agriculturists (mostly Jats) and with personal training make suitable assistants for the charge of demonstration farms. The staff is still inadequate for the size of the circle.

Agricultural stations.—These remain as last year, viz., the Cawnpore Experiment Station and Kalianpur Seed Farm at Cawnpore, the Etawah and Mainpuri Demonstration Farms in the *doab* and the Atarra and Orai Experiment Stations with the Madhogarh Demonstration Farm in Bundelkhand. There is no farm in the Oudh portion of the circle and it is hoped that one will be opened as soon as money is available; promises of local financial help have been received from two districts.

District Work.

Cotton.—In the Cawnpore, Farrukhabad, Mainpuri and Etawah districts the introduction of Cawnpore-American cotton is being continued. The estimate of 5,000 acres for last season proved much too high, as much of the seed issued was not sown, in many cases owing to lack of irrigation facilities. The area sown as far as it could be ascertained was 2,200 acres, of which some 360 acres in the Cawnpore district failed for want of water in the first few weeks. Arrangements were made for the sale to the Elgin Mills of the cotton produced and small quantities were also taken by other mills in Cawnpore. The quantity of lint made over to the mills amounted to the equivalent of 450 bales (of 400 lb.) but we had ample evidence that much of the cotton did not pass through our hands but was sold in the open market. Some of it seems to have been used for mixing with *desi*—a practice which can only result in loss to the grower.

It is now definitely established that this cotton if carefully handled and ginned is equal to middling American and arrangements for its sale are made on this basis. The closing of the cotton exchanges as a result of the war upset all our arrangements for the sale of the 1914 crop, but eventually the cotton was all sold at a price which enabled us to pay the growers a premium of 25 to 40 per cent. above the price of *desi kapas*. Arrangements for the sale of the 1915 crop have been made with the Muir Mills up to a certain limit and the balance will be offered on the open market. No estimate of the area in 1915 can be given as figures for the area sown have not yet been received. It is known, however, that the demand for canal water for other crops, such as indigo, has reduced the supply available for early cotton sowing in some of the tracts where American cotton was doing best and this with last year's comparatively low prices will make the area much lower than it would otherwise have been. Numerous complaints have been received that sufficient water was not available.

In Unao and Hardoi districts the distribution of Aligarh white-flowered cotton seed was continued 550 maunds being supplied which is sufficient for 4,400 acres. Apart from this a large area was sown from cultivators' own seed. Crop cutting experiments* in Unao showed that this variety yielded 50 to 70 per cent. more than the local *desi* and in spite of low prices it was possible to pay a small premium for the *kapas* on account of the high ginning percentage. The demand for seed during the present season is smaller partly because the cotton is now established in certain villages but largely because of the unpopularity of the cotton crop in this tract as a result of last year's low prices.

The Hardoi and Sandila Co-perative Societies have now started definite seed schemes for the supply of seed of this variety and the latter this year purchased from selected members enough *kapas* to supply seed for 800 acres. Local buyers at Sandila also paid the same premium for the *kapas* as paid by the Co-operative Society and the department.

In Bundelkhand K7 cotton was distributed on a considerable scale, in Jalaun 13 maunds being supplied which is sufficient for 100 acres. Eighty-three maunds of Rath seed was also supplied. The results obtained were not so good as last year probably owing to the fact that no canal water being available sowings were later than usual and also because the season was too wet for cotton. During the present year a more extensive trial of this variety is being made in both Jalaun and Hamirpur.

Wheat.—Pusa 12 wheat having been proved to be the best for the *doab* and Oudh portions of the circle its systematic introduction was taken up. Applications for seed were greatly in excess of the supply and only 1,520 maunds could be issued. This was chiefly concentrated in Hardoi, Sitapur and Etawah but smaller quantities for demonstration purposes were also supplied in other districts.

In Hardoi the whole of the seed was supplied through the Hardoi and Sandila Co-operative Banks as also a small quantity in Mainpuri. In Hardoi this wheat did well although the germination was poor in many cases. In Sitapur it did invariably well and in Cawnpore, Etawah and Mainpuri stood out as fully 50 per cent. better than either local or *desi* wheat. As a result we now have a demand for seed far in excess of the available supply but some 2,700 maunds

* For details, see Cawnpore Farm Report.

will be issued this year. The available supply is being concentrated and chiefly issued to Co-operative Banks and to zamindars who enter into agreements to return a moiety of the produce to us for further seed supply.

With the co-operation of the Hardoi Co-operative Bank, the Sitapur Court of Wards and some Etawah zamindars it has been possible to buy in enough of this year's produce for an experimental shipment to England, in co-operation with the Imperial Economic Botanist, in order to establish the value of this wheat in the English market. The variety has however become so popular that great difficulty was experienced in getting together the required amount and there is every indication that it not only commands a premium in the local bazars but that cultivators and zamindars are keeping a lot for seed.

Quality of Pusa 4.—In Bundelkhand Pusa 4 was issued in the Banda and Jalaun districts for irrigated land. In Banda this variety stood out as far better than others as regards yield, standing power and resistance to rust. A big demand for seed is arising. In Jalaun on the irrigated *kabar* the behaviour of this wheat was variable. In some cases excellent yields were obtained, in others owing to a poor germination or early withering due to the high temperature at sowing time, a poor stand was obtained and as this wheat is not a strong tillering variety the yields were directly affected. To this result the very late opening of the canal largely contributed and the effect on *desi* wheat was also marked. Canal water was received too late to permit of either early irrigation to early sown wheat or of late sowings with *paleo* for which this variety is well suited. The yields from Pusa 4 were however better than the stand indicated as the grain was well matured and free from rust and the ears large. Some 1,300 maunds of this variety will be issued next *rabi*. In Hamirpur a considerable amount of Soharia wheat was supplied for *kabar* soil and on the whole did well.

In Kheri the Court of Wards Estates are continuing the scheme they have started for the introduction of Pusa 106 wheat and the Special Manager reports that it has done uniformly well and is rapidly replacing *desi*, about 1,000 acres being sown with this variety in 1914-15 *rabi*. Experiments are being made to see whether it does better than Pusa 12. So far Pusa 106 has done well in Kheri whilst at Cawnpore it has not been so satisfactory as 12 but it is possible that 106 is better in submontane tracts.

The difficulty in providing an adequate supply of wheat seed of improved varieties is marked. Buying back from cultivators and zamindars has its limitations and is difficult with a small staff. While the system of seed stores and distribution schemes now being organised with the various co-operative societies will go far to solve the problem the necessity of a larger seed farm at Cawnpore to act as a centre of purity is becoming more and more necessary and not only in the case of wheat.

Sugarcane.—With the co-operation of Messrs. Begg, Sutherland and Co. an area of some 70 acres of Reora *ukh* has been established in the Cawnpore district this cane giving a much purer juice and better yield of *gur* than the local canes. Smaller amounts of Java 33 and Ashy Mauritius canes were also issued. The two latter varieties have also been issued in smaller quantities in several districts for demonstration and trial. With the co-operation of the Agricultural Chemist to Government 400 maunds of Ashy Mauritius and 300 maunds of Java 33 were supplied, most of which was supplied from the sugarcane farm at Shahjahanpur.

No progress in the introduction of sugarcane in the Banda district was possible as the Ken canal cannot yet supply regular *kharif* irrigation.

Rice.—Demonstrations of the value of transplanted rice were carried on in the Ken canal division and these are being extended this year. As canal water is always available from the river (as distinct from the reservoirs) in September transplanted rice can be assured in this tract and four years' experiments at the Atarra Farm have amply demonstrated its value.

Juar.—9,820 lb. of juar seed of selected varieties were issued for district trial and all did well.

Arhar.—4,531 lb. of early arhar, for sowing with cotton (or pure), were issued during the year and the popularity of this variety is growing. We were unable to meet all the demands for seed.

Groundnuts.—The large Japanese variety is now established and it is only necessary each year to buy in sufficient seed for providing for extensions. There was a decrease of some 1,500 acres in the area under groundnuts, the chief decrease being in Cawnpore, Unao, and Hardoi which is probably largely accounted by increased areas put under cotton and juar after a year of scarcity. Farrukhabad district has shown an increase however.

General agricultural practice.—Demonstrations of transplanted rice in Banda have already been referred to. No district work on the eradication of *kans* was possible as the motor plough arrived too late to permit of experiments last cold weather.

The introduction of irrigated cotton in Jalaun was temporarily interrupted last season by the absence of canal water and this year also the supply has been so small that the area sown with irrigation on the Betwa canal has been nominal. Demonstrations have been started also in the Dhasan canal division.

Deep sowing of maize for light soils near Cawnpore has been demonstrated. Some 800 maunds of castor cake have been supplied for sugarcane manuring.

Potato storage.—Demonstrations of the method of storing in sand to avoid the ravages of the potato moth have been continued. In 1914 there was a small loss on the demonstration store at Farrukhabad owing to damage by fungus disease. Further experiments are being

made both there and at Cawnpore to deal with this additional complication. The method of sand storage has successfully prevented damage by the potato moth and this year twenty-three men have stored 5,850 maunds by this method and one dealer has also stored 2,000 maunds in sand. Besides this most of the cultivators in four villages have stored their own seed in sand in quantities of 5 to 15 maunds so that the total quantity of potatoes stored by our methods is large.

Experimental work.—At the Cawnpore Farm comparison of varieties of wheat, cotton, juar and sugarcane have been continued. Pusa 12 wheat has proved to be the best for the greater part of the circle (excluding Bundelkhand), Cawnpore-American cotton for the irrigated districts of the *doab* and Aligarh white flower cotton for Oudh. These crops are all grown on a large scale at the Kalianpur Farm for seed supply. Experiments in the improvement of Cawnpore-American cotton by selection have been continued and a number of selections are now being tried on a field scale; the object is to improve the uniformity of the crop and to raise the ginning percentage. Some selected juars are now being given a district trial. Java 33 and Ashy Mauritius canes are being given an extended trial this year. The value of hot weather ploughing has now been thoroughly established at Cawnpore (and at other farms.) It seems probable that a small alteration in the system of irrigation charges might appreciably assist the introduction of this improvement. At present a cultivator using canal water for the irrigation of a juar or cotton stubble for ploughing in December-March is charged an additional *paleo* rate. In view of the fact that an economy in the use of canal water in the following *rabi* results in most years—in addition to an increased yield of wheat—it would seem worth while including the water used for stubble ploughing in the general charge for the wheat crop. It may also be pointed out that the early ploughing of stubbles is an important method of controlling the insect pests of cotton and juar. The results with green manuring continue to be uncertain and it has not yet been determined what conditions are necessary to ensure success. At the Atarra Farm, however, green manuring has been a consistent success and in this area demonstrations are being started. Flax has again done at Cawnpore well yielding 41 maunds of rippled straw per acre, 11 per cent. of clean fibre and 11·3 per cent. of tow. Flax growing would pay well in the irrigated portion of the circle if capitalists would take up the retting and scutching, but these operations are expensive on a small scale and unlikely to be done well in villages.

Further experiments with fodder crops are in progress; Teff (Eragrostis Abyssinica) continues to be very promising.

The Kalianpur Farm is at present used for seed growing and large scale experiments only but with a recent reduction of the area of the Cawnpore Farm by transfer of land to the College Farm, it will be necessary to transfer a good deal of experimental work to Kalianpur.

Receipts from the Kalianpur farm for the year amounted to Rs. 5,139 being about Rs. 2,000 lower than was expected owing to the heavy fall in the price of cotton. Ordinary expenditure amounted to Rs. 5,657, and capital expenditure to Rs. 3,342, the greater part of which was spent on a new seed godown.

The demonstration farms at Mainpuri and Etawah are used for local testing of varieties prior to introduction and for demonstration work generally. The Mainpuri Farm is managed by the local Agricultural Association with a grant from the Department which also supplies and controls the supervising staff. The Etawah Farm is now large enough to grow an appreciable amount of seed for local issue.

At the Orai Farm the principal experiments are concerned with the testing of wheat, gram and juar varieties for that area and with cultivation experiments on *Mar* and *Kabar* soils. Some work is also done on cotton but as the Madhogarh Demonstration Farm is situated in the cotton tract variety testing is mostly done there. The Pusa 4 and Soharia varieties of wheat have done well and a third selected at the farm from Banda Sarbati is promising. Results at Madhogarh show that Pusa 12 wheat is the best for the *pawa* tract in north Jalaun. Some of the selected juars have given excellent results and issue of these has begun, testing of other selections continues. K7 (previously referred to as Type 7) cotton did not do as well in Jalaun as last year but is being tried further. Some selections from Bundelkhand local cottons (made at the Cawnpore Farm) will also be tried. Various hybrids from the Economic Botanist are being tried also at Orai and Madhogarh.

The Atarra Farm is situated on the Ken canal on typical *pawa* soil and is chiefly used for experiments with wheat, sugarcane, rice, and juar. Pusa 4 wheat has in two years done very well here and also in the district and its introduction is being taken up. Several good varieties of rice have been established and are being distributed. It has been shown that with canal irrigation transplanted rice is much more profitable than broadcast and this is being demonstrated. The selected juars from Orai have done well. Sugarcane does well here provided that ample water is available; this year the thick canes suffered from insufficient irrigation but Reora *ukh* again did well.

Green manuring has done consistently well on this farm and demonstrations will now be started. Canal water is always available in September to complete the rotting if required.

Hot weather cultivation has also given consistently good results but there is difficulty in its general application.

General.—Close relationships with the co-operative societies of the circle again form a feature of the year's work. The Hardoi, Sandila, and Jasrana Central Banks are all working definite schemes of seed distribution and the two last have their own seed stores while the Hardoi

Society hires suitable godown accommodation. In Mainpuri a special co-operative society has just been formed for the supply of seed to the shareholders, zamindars of the district, and to the co-operative societies. Seed was also distributed through the Unao Town Bank, the Padri Bank, the Ramnagar Bank, the Fatehpur Bank, and on a smaller scale through others. With the exception of American cotton the bulk of the seed issued from Cawnpore is distributed through Co-operative Banks. Several banks also carry stocks of implements recommended by the department.

The Sitapur Court of Wards Estates have also taken up the issue of selected seed chiefly Pusa 12 wheat and not only was this successfully distributed and grown but the Special Manager also made arrangements for buying in part of the produce for the experimental shipping scheme. It is hoped that this group of estates will possess their own seed godown shortly.

The Kheri Court of Wards Estates also have a definite scheme in progress for the steady replacement of *desi* by Pusa 106 wheat. The Tirwa Court of Wards Estates has taken a considerable amount of wheat seed during the last two years and Pusa 12 did well there but as the supply this year is only about a quarter of what was anticipated (owing to the partial failure of the crop in Bihar) and as the Special Manager is unable to make any arrangements for buying back the produce it has been necessary to discontinue the supply of Pusa 12 wheat to this area until the more advanced tracts have been firmly established.

Agricultural education.—Six selected elementary school teachers were admitted to the Cawnpore Farm for practical instruction in improved agricultural methods. Two from the Allahabad district have completed their course and returned and four from the Etawah district will return there at the end of July.

Distribution of seed and implements.—As the end of the departmental year does not coincide with the end of an agricultural season the figures given below do not tally with those in the body of the report as they contain part issues for kharif 1914 and part for kharif 1915, issues for which continue.

From the central seed store at Cawnpore, *3,213 maunds of seed, excluding sugarcane for 80 acres, were issued of which the most important were: wheat 2,289, cotton 606, juar 119, early arhar 55, and groundnuts 38.

The Atarra Farm supplied 887 maunds of seed of 21 kinds to 570 persons; the principal items were wheat 351, sugarcane 228, juar 147, rice 57, and groundnuts 48. Much of this was supplied in small quantities for demonstration purposes.

The Orai Farm supplied 574 maunds of seed of which the most important items were wheat 383, cotton 142, juar 14, groundnuts 10, early arhar 2½. This excludes 702 maunds of Soharia wheat purchased for supply to Hamirpur.

From the Etawah Farm 413 maunds of seed were issued, exclusive of issues to this district from Cawnpore, of which the principal items were sugarcane, Pusa 12 wheat and American cotton.

Madhogarh Farm issued 310 maunds of seed of which the principal items were wheat 206, cotton 95, and juar 7½.

A considerable quantity of juar, 836 maunds, was also purchased for supply to Jhansi district where there was a shortage of seed after the famine.

Two hundred and fifty-one implements of 22 kinds were supplied from Cawnpore during the year of which the chief items were ploughs 161. A considerable number were also sold and given on hire by various sub-centres. Orders for 10 implements were passed on to the Cawnpore Agency of Messrs. Octavius Steel & Co. The Etawah Farm sold 38 implements including 5 sugar mills and 13 ploughs. The Atarra Farm sold seven implements and issued 67 on hire or hire purchase. The Orai Farm sold 14 implements.

Correspondence.—Four thousand one hundred and eighty-five letters were received and 3,772 issued; enquiries for agricultural advice numbered 786 apart from those dealt with direct by the farm staff and touring staff.

Receipts.—The receipts for the circle during the year amounted to Rs. 15,975, all farm receipts being materially lowered by the fall in the price of cotton. Demonstration Farm receipts (Etawah and Madhogarh) amounted to 1,237 rupees which represents less than half the receipts of the year as the wheat crop is still in stock being retained for seed.

Publications.—A Vernacular pamphlet on ploughing was issued during the year, the following Vernacular pamphlets are in the press :—

1. List of crops recommended for the Central circle.
2. Hot weather ploughing.
3. Green manuring (Banda district).
4. Manures.
5. Inter-cultivation for juar arhar.

B. C. BURT, B.Sc.,
Deputy Director of Agriculture.

* 1 maund = 82·3 lb.

APPENDIX III.

Report on the administration of the Eastern Circle of the Department of Agriculture, United Provinces, for 1914-15 *by* MR. L. C. SHARMA, M.R.A.C., P.A.S.I., *Assistant Director of Agriculture.*

Staff.—I remained in charge of the Eastern Circle throughout the year.

The work of the Eastern Circle done during the year under report may be classified as follows :—

1. Experimental investigations.
2. Demonstration work.
3. Multiplication of the approved seeds.
4. Replacement of the local inferior varieties of grains by those that have proved more suitable for the locality both as regards yield and quality.
5. Miscellaneous work.

Now taking them by turns, I beg to submit as follows :—

1. Experimental investigations. These were carried out chiefly at the Partabgarh and the Benares Agricultural stations and the details of this work together with the results obtained as compared with those of the last year are given in the respective reports of the said stations for the year 1914-15. I shall therefore mention below only a few points in brief regarding the results of some of the investigations :—

(*a*) The results of the varietal experiments with sugarcane (thick and thin), wheat, barley, paddy, groundnut, maize, bajra, and peas corroborate with those of the past years and show that Saretha of Muzaffarnagar, Reora of Benares varieties of thin canes, Mauritius No. 16, Ashy Mauritius and Barbadoes No. 1529 varieties of the thick canes, Pusa No. 12 Wheat, Improved barley, Bansphul, Hansraj and Bansmati paddy varieties, large Japanese groundnuts, Jaunpur maize, Thorny bajra and white improved peas are most suitable for the locality both as regards yield and quality. They are now recommended for this circle and efforts are being made for increasing their stock to meet the existing demand.

The demand for Pusa No. 12 wheat which did extremely well on extensive trials in some of the districts as shown below is increasing very rapidly and special arrangements have been made to meet it as far as possible.

The rust resulting from the March rains damaged the local wheat crops to a considerable extent but Pusa 12 was affected very slightly in a few districts only while not at all in the others.

(*b*) The results of the manurial experiments show that nim cake applied to paddy at the rate of 600 lb. per acre will increase the produce by 50 per cent. per acre.

(*c*) The seedling and spacing experiments with paddy show that transplanting of one seedling at 8″ apart gives the best results.

(*d*) Seed rates for wheat 40 to 50 seers and for thin canes 16,000 to 18,000 cuttings per acre have given the highest outturns.

(*e*) Green manuring with san hemp gave 34 maunds grain of Pusa 12 per acre at the Benares Agricultural Station.

(*f*) Dofasli Rotation (i.e. two crops in rotation in the same year). The results of this experiment show that maize and potatoes in rotation can give a net profit of Rs. 263 per acre and that groundnut and tobacco in succession Rs. 132-9-6 per acre.

(*g*) Improved drainage for wheat at the Partabgarh Agricultural Station under directions of Mr. Howard, the Imperial Economic Botanist.

Mr. Howard was kind enough to show me on the spot while he visited the Partabgarh Agricultural Station in March 1915 how to lay out the improved drainage on a piece of about 5 acres in the front position of the Agricultural station.

The drainage has been most carefully laid out and the drained area will be put under Pusa 12 and the improved barley next season.

(*h*) Preservation of fodder in Silo. The Silo experiments were conducted in the Co-operative Dairy at Lucknow, the Partabgarh and Benares Agricultural Stations.

The results of the experiments made in places mentioned clearly show that (1) fodder can be preserved in Silos for nearly a year and even longer. (2) The silage when taken out and exposed to air for a few minutes is well relished by all kinds of cattle. (3) It is far more nutritious and digestible as compared with the fodder given to dairy or any other cattle at a time when fodder is scarce. (4) For want of sufficient fodder and large number of cattle in the dairy, it was not possible to ascertain how far the milking capacity of a cattle can be increased. This point will be ascertained next year. Use of silage will prove profitable only when one could either grow his own fodder or purchase it at a cheap rate.

(*i*) Eradication of Roshna and Rari weed. The experiments carried out during the last three years for eradication of Roshna and Rari weeds by deep ploughing with iron ploughs in the Jaunpur and Ballia districts respectively, have met a great success and proved that a crop of wheat or barley can most profitably be taken

by eradicating these weeds with deep ploughing during the previous rainy season. The experiment is however somewhat expensive and this difficulty can easily be overcome, and thousands of acres, now under the above mentioned weeds, can be reclaimed in a few years if a motor plough is used for eradication instead of the iron ploughs.

2. *Demonstration work.*—Some of the definite results obtained at the Government Agricultural stations of this circle, made it quite essential that the interested zamindars and cultivators should be brought in touch with them.

With this object in view several district demonstration farms were opened and hundreds of various demonstrations given in the cultivators' fields in several districts. A very brief mention of these is made below.

(*a*) *Rae Bareli Demonstration Farm.*—This farm is situated on the pakka road just opposite to the Revenue courts, about 1½ miles from the railway station and is known as Turner Farm.

The area of the farm is 11·65 acres, which has been taken from the Nazul authorities on a rent of Rs. 127-4-6 per annum.

Only ⅓rd of the area is irrigable from the well just outside it.

The chief Demonstrations given on this farm on a large scale were with (1) Pusa no. 12, (2) selected varieties of canes, (3) deep ploughing with Meston plough.

A large number of taluqdars, interested cultivators and the special manager of Court of wards, being well impressed with the splendid crops they saw on this farm last year, tried 180 maunds of Pusa no. 12, 100 maunds of thin seed canes and 800 thick sugarcanes in their own fields, under instructions of the Agricultural Superintendent in charge of that district.

Pusa no. 12 yielded on an average 5 maunds grain more per acre than the local wheat, that is to say Pusa no. 12 gave an increase of Rs. 25 per acre.

The whole area of wheat in the Rae Bareli district was 28,298 acres. Thus if the whole area were put under Pusa 12, the district would have been benefited by Rs. 7,07,450 from this crop alone in one season only.

(*b*) *Sultanpur Demonstration Farm.*—This farm is situated just close to the railway station and the public has got an easy access to it on account of the two public roads passing through it.

The area of the farm is 7·47 acres. It was acquired from the Nazul authorities under orders of the Commissioner, Fyzabad, in 1913.

One ordinary well has been constructed but it does not supply sufficient water for irrigation.

The fact that seed of Pusa 12 wheat and of various other improved crops, was distributed last year and that a large number of zamindars and cultivators come to visit the farm crops and operations almost every day, shows what a great interest has been created among them about the improved crops and the methods of cultivation.

A sum of Rs. 2,000 has been placed at the disposal of the Department by the District Board for opening a seed dépôt.

The farm was managed by Babu Bhagwati Prasad throughout the year who made a net profit of Rs. 54 per cent. on the investment of the farm.

(*c*) *Jopling Demonstration Farm, Ballia.*—This farm was started in March 1912 by Mr. L. M. Jopling, the then Collector of Ballia, in the Headquarters area. The area of the farm is 20 acres and situated on a pakka public road. Half of the area is irrigable by a well and a nala close by it. The farm is worked by the Department and financed by the Headquarter funds.

This farm is doing an excellent work chiefly in introducing groundnut, yellow flowered cotton seed in place of a local variety of cotton which gives a very poor yield and occupies the field for the whole year. It is satisfactory to note that the farm became self-supporting in the 2nd year and returned Rs. 300 to the District Board funds during the year ending with 30th September 1914, as profit which is more than equal to the rent previously realized by the Board from the land now given to the farm.

(*d*) *Other Demonstration Farms*:—The Demonstration Farms of Bara Banki, Ghazipur, Ajodhia and Bahraich have also done a very useful work on the lines of the farms mentioned above.

(*e*) Statement showing the number of demonstrations given in various districts :—

Serial number.	Name of district.	No. of demonstration given in cultivators' fields.
1	Partabgarh	1,150
2	Sultanpur	337
3	Benares	120
4	Ghazipur	100
5	Fyzabad	100
6	Rae Bareli	93
7	Ballia	31
8	Bara Banki	11
	Total ..	1,942

(*f*) Effects of the demonstrations and the Demonstrations farms :—

(i) The people, who believed that the higher outturns from improved seeds can only be had at a heavy expense, have now begun to realise that ordinary expenditure, in most of the cases not exceeding that of a cultivator's, is quite sufficient to grow bumper crops yielding almost double the outturns of superior quality.

(ii) The fact that Meston plough can be worked most economically and profitably with a pair of ordinary bullocks, is being made quite familiar to the zamindars and cultivators, and this has created a great demand for the Meston plough.

(iii) A large demand for improved seeds has been created.

(iv) Zamindars and cultivators are getting familiar with and convinced of the work done at the Government Agricultural stations of this circle.

(v) A demand for considerably more assistance and instructions from the staff of the circle.

The staff engaged at present is quite insufficient to cope with the existing demand which is increasing rapidly.

3. *Multiplication of the approved seed.*—There being no Government Seed Farms in this circle, well-to-do zamindars and Taluqdars were approached in the year before last to open small Farms of their own under the supervision of the Department.

Several gentlemen who were interested in Agriculture came forward to work in co-operation with the Department and a few farms were opened.

The number of the private farms thus arose from 4 to 40 in the last year. Most of these farms gave highly satisfactory results last year and have therefore been considerably extended and many more added to the list during the year under report. A good many of the owners have supplied me with copies of detailed reports of their respective farms, which show splendid success and large profits, but the want of space does not allow me to make a mention of them even briefly in this report so I content myself only by giving a list of only those farms which are 20 acres or upward in areas together with the names of the owners thereof (Appendix A) with cursory remarks, but in order to show that there is hardly any industry which can be more profitable in this country than the agriculture industry, and the extent to which an interest in agriculture is growing among taluqdars and others, I make a brief mention of the farms started by the Raja of Amethi. In 1912 the Raja of Amethi in consultation with the department, tried Pusa wheat nos. 8 and 12 at Dhamrawan on a small area suited for wheat. The results obtained from Pusa 12 were so satisfactory that the Raja was pleased to try it on a much larger scale next year. In March 1914 his Pusa 12 wheat stood first in the Sultanpur exhibition. He then arranged to put about 20 acres under Pusa 12 and about 32 acres under Bansmati (a very fine paddy) recommended by this circle, at Kosaha, where only a coarse variety of paddy was previously grown and which is about a mile from his palace. This area as well as that of Dhamrawan mentioned above have now been considerably extended making a total of 200 acres. The former is now known as Dhamrawan Farm and the latter as Jang Bahadur Farm. This was visited by Mr. and Mrs. Howard the Imperial experts in 1915, who were much pleased to see the crop of Pusa wheat in this farm. Mr. Howard left the following note in the Visitors' Book of that Farm.

True copy.

The Raja of Amethi showed us the Jang Bahadur Farm at Ram Nagar this morning and the fine crop of Pusa 12 wheat. The farm is exceedingly well laid out and a very good piece of typical wheat land has been selected for the purpose. The seed will, I understand be distributed to the tenants of the Raja. If all the Taluqdars of Oudh would take as much interest in the development of agriculture as the Raja has done, the work of the Agricultural Department would be much lightened, and fresh progress would be made in a very short time.

PUSA ; A. HOWARD,

Dated the 3rd March 1915. *Imperial Economic Botanist.*

It might be mentioned here that the areas of these Farms were previously under jungle which has gradually been cleared away since 1908. Out of the produce of these farms the Raja got 2,500 maunds of improved seeds, the value of which was about Rs. 10,000 not including bhusa. The kharif seeds have been issued on Sawai and the rabi seeds including 350 maunds of Pusa 12 are stored up for issue in October next, in the three seed dépôts, Gauriganj, Gangauli and Amai which the Raja has opened and are worked up on the lines of the Government Seed Dépôts in this circle. In short, the results obtained from these Farms in spite of the adverse season, were so highly satisfactory and encouraging to the Raja that he was pleased to open three more farms about the end of the year under report. One of them is a wheat Farm, the object of which is to keep the stock of Pusa no. 12 pure, the second is an Usar farm of over 100 acres the object being to ascertain how far and at what expense the usar land can be reclaimed. The third farm is about 400 acres in area and a mention of this will form the subject of the next year's report. The Raja is arranging for a suitable pumping plant and other agricultural machines and implements and has, under certain conditions entrusted the management of the Usar Farm and the one mentioned last entirely to the Department.

Chandapur Farm, Kurri Sidahuli Farm and a few other farms are also making a rapid progress and doing a similar good work. Thus the greatest difficulty, which existed in securing some unofficial agency that could take over approved varieties for multiplication, has to some extent been overcome.

The main feature of the scheme is the arrangement by which the private farms shall take from the department, a prescribed quantity of approved seeds which will be sown in them, and the produce thereof either sold to the Department at the market rate or issued on sawai system under supervision of the Department to a group of the selected cultivators who will undertake (1) to sow them in a prescribed circle in which the local varieties of those seeds will not be sown, (2) to thresh their crops in a separate yard to avoid risk of any seed being mixed up with the local variety and (3) to sell half of the produce after returning the quantity due under sawai, to the Farms concerned, if it be so desired by the respective owners thereof in order to enlarge the stock for issue to various other similar circles next season.

4. *Replacement of the local inferior varieties of grains by those that have proved more suitable for the locality both as regards yield and quality.*—This is affected by means of seed dépôts. There are now, in this circle, 15 Government seed dépôts, which are being financed out of the advance of Rs. 15,000 sanctioned for the purpose four District Board seed dépôts which are financed by the District Boards of Sultanpur and Fyzabad under the supervision of the Assistant Director and 5 private seed dépôts which are financed by the respective owners thereof under their direct supervision, making a total of 24 in all.

From the Government and District Board seed dépôts alone maunds 14,153-8-0 improved seeds of all kind, viz. 2,864-27-1 of kharif seeds and 11,288-20-15 of rabi including maunds 705-24-10 Pusa 12 was distributed on usual sawai system, compared with maunds 14,118-7-8½ viz. 2,817-2-11½ of kharif and 11,301-4-13 of Rabi seeds in the previous year. Besides 1,070 maunds was sold away on cash price to various indentors and private farms and a large quantity of seed maunds 250-31-4 was made over to the seed dépôt at Aurai opened by the Benares Raj on our lines. The financial position of the Government seed dépôts is perfectly sound. It will suffice to mention here that (1) only the superior varieties of seed collected from the produce of the original seed grains advanced, are issued from the seed dépôts. (2) No two such varieties of a grain are kept in or distributed from a seed dépôt which cannot be easily distinguished from one another. (3) The seed is distributed within prescribed circles, the radius of which do not exceed three miles, but if in some case this is unavoidable some large blocks are selected outside the circle but not beyond six miles from the centre of a circle.

5. *Miscellaneous work.* (*a*) *Training in practical agriculture.*—To meet the demand of the demonstration and the private farms for trained fieldmen it was found quite essential to receive a few selected students and give them a training in practical agriculture on the Partabgarh agricultural station. Six students were taken last year out of which three were sent by the Taluqdars of this circle and eight during the year under report including two sent by the Taluqdars of this circle and one by the Secretary, Co-operative Societies, Benares. Of the above-mentioned students three have been employed as fieldmen on the Government farms and two as seed dépôt moharrirs, while three have been returned duly trained up to the Taluqdars concerned to supervise their respective farms. The rest are still under training.

(*b*) *Sale of agricultural machines and implements through the Government Farms of this circle.*—The useful functions discharged by the various district demonstration farms and the demonstrations given in the cultivators' fields, in bringing the public in touch with the work of this circle, have raised the demand for improved agricultural appliances.

(*c*) *The vernacular agricultural journal:*—The journal is known as *Risala-i-Mufidul Mazarine* and was issued regularly every month throughout the year under report. Seventy-three articles on various important agricultural matters appeared in the journal during the year under report, some of which were reproduced by a few other vernacular journals. But as it did not meet the requirements of the Nagri-knowing public, a monthly agricultural journal in Nagri called *Kisanupkarak* has been started and is being issued regularly since October 1914.

The total circulation of both the journals was 1,074 during the year under report and it is expected that it will increase considerably next year. These journals meet the requirements of the people who are anxious to know what agricultural improvements have been made on the various agricultural stations and that what benefit and how they can derive from them.

(*d*) *Correspondence.*—The total number of letters received and issued were 2,566 and 2,807 respectively during the year under report as compared with those of the last year which were 1,679 and 1,828 respectively.

A large number of demi-official letters issued by the Assistant Director is not included in any of the figures mentioned above. The rapid increase of correspondence shows the extent of rising interest of the people in agriculture.

L. C. SHARMA, M.R.A.C., P.A.S.I.,
Barrister-at-Law,
Assistant Director of Agriculture.

APPENDIX A.

List of the Private Farms in the Eastern Circle.

Serial number.	District.	Name of the Farm.	Owner's name.	Area.	Remarks.
1	Benares ..	Sirsaul Farm ..	Dr. Kidarnath Singh ..	50 acres	Made a net profit of Rs. 500.
2	Do. ..	Khanna Demonstration Farm.	Mahraj Kishri Khanna, Zamindar and General Manager, Benares Bank.	20 „	Opened in 1915.
3	Do. ..	Gautum Farm ..	Babu Manohar Lal Gautam, Benares City.	25 „	Ditto.
4	Jaunpur ..	Gaddupur Farm ..	Vazianagram State ..	20 „	Ditto.
5	Do. ..	Rana Demonstration Farm.	Lala Ram Das, Zamindar, Benares City.	35 „	Ditto.
6	Mirzapur..	Pandepur Farm ..	Lala Mahadeo Prasad, Zamindar.	30 „	
7	Do. ..	Sri Radha Madho Farm, in village Pathorkhura.	Lala Madhusudan Das of Benares.	275 „	Opened in 1915.
8	Do. ..	Kundi Farm ..	Ditto ..	150 „	Ditto.
9	Do. ..	Ahraura Farm ..	Ditto ..	50 „	Ditto.
10	Do. ..	Sewari Farm ..	Ditto ..	30 „	Ditto.
11	Do. ..	Mamari Farm ..	Ditto ..	60 „	Ditto.
12	Do. ..	Raikal Farm ..	Ditto ..	70 „	Ditto.
13	Do. ..	Manjhiara Farm ..	Ditto ..	40 „	Ditto.
14	Do. ..	Garda Farm ..	Babu Madho Prasad ..	40 „	Ditto.
15	Rae Bareli	Kurri Sudauli Farm ..	The Hon'ble Raja Rampal Singh Sahib, C.I.E.	60 „	Pusa no. 12 gave full satisfaction and the farm made 23·5 per cent. profit.
16	Do. ..	Chandapur Farm ..	Raja Chanderchur Singh Sahib.	165½ bighas	Extended by 50 bighas. Pusa 12 gave excellent result. The farm made a profit of Rs. 146 per cent.
17	Do. ..	Brahmani Farm ..	Court of Wards Estate, Rae Bareli	40 acres	Pusa no. 12 wheat gave highly satisfactory results.
18	Do. ..	Khurchti Farm ..	Sardar Prem Singh ..	48 „	
19	Do. ..	Saraini Farm ..	..	50 „	
20	Do. ..	Rahuan Farm ..	Thakur Jagan Nath Bux Singh.	20 „	Opened in 1915.
21	Do. ..	Pithan Farm ..	Thakur Devi Bux Singh	30 „	Ditto.
22	Do. ..	Gaura Farm ..	Thakur Sheo Narain Singh.	20 „	Ditto.
23	Do. ..	Sheogarh Farm ..	Raja Sahib, Sheogarh ..	20 „	Ditto.
24	Do. ..	Seauka Farm ..	Babu Janki Prasad ..	20 „	Ditto.
25	Do. ..	Raja Man Farm ..	Thakur Sheo Narain Singh.	30 „	Ditto.
26	Partabgarh	Tala Farm	Thakur Raghunath Singh, Taluqdar Isanpur.	47 „	
27	Do. ..	Partabgarh Fort Farm	Raja Partab Bahadur Singh.	23 „	
28	Sultanpur	Degarpur Dehma ..	Deara Estate ..	71 bighas and 17 biswas.	Opened in 1915.
29	Do. ..	Kusha Farm ..	Amethi Estate ..	30 acres	
30	Do. ..	Jang Bahadur Farm ..	Ditto ..	27 „	
31	Do. ..	Dhamrawan Farm ..	Ditto ..	40 „	Extended by 25 acres. Pusa 12 gave double the outturn as compared with local wheat.
32	Do. ..	Naugawan Farm ..	Amethi Estate and Department.	400 „	Opened in 1915.
33	Do. ..	Usar Farm.. ..	Ditto ..	100 „	Ditto.
34	Fyzabad ..	Milkipur Farm ..	Babu Bipin Chandra Chatterji, Vakil.	50 „	Ditto.
35	Lucknow..	Mallaupur Farm ..	Mr. Ramapat Ram, M.A., LL.B., Lucknow.	30 bighas	Ditto.
36	Do. ..	Dehwá Farm ..	Court of Wards, Lucknow.	40 „	Ditto.
37	Do. ..	Mau Farm	Ditto ..	37 „	Opened in 1915.

APPENDIX IV.

Report on the administration of the Agricultural College, Cawnpore, for the year 1914-15, *by* MR. H. M. LEAKE, *Principal.*

From 1st June 1914 to 1st October 1914 the post of Principal of the College was held by Mr. A. W. Fremantle, and on the latter date I assumed charge in addition to my own duties as Economic Botanist to Government, United Provinces. My assumption of charge was coincident with the introduction of a scheme for reorganisation outlined in Government order no. 165L of 1914, dated the 21st September 1914. The revised scheme affects the whole aim and the organisation of the College and the latter months of the year have therefore been ones of change. By the Government order referred to, the three years' English course is replaced by a four years' English, and a two years' Vernacular, course. The change has necessitated large modifications of staff and especially syllabus. These naturally take time to develop and it is, therefore, too soon to expect clear indication of the extent to which the new system is fulfilling its object.

That object is to attract the younger generation of larger landholders, the zamindar of future— and give him a training or education which will develop in him a personal interest in his own property. That such men will be forthcoming at once in numbers is hardly to be expected. The development must be gradual, but this aim is kept in the forefront in selection for admission and in the detailed development which is now going on.

In spite of brief notice, the number of applications for admission to the Vernacular class was large and 19 students were admitted in October and the class raised to its maximum of 26 in January 1915. The total number of applications being 144. Twelve students were admitted to the new four years' course. The next session begins in October, applications for which will be received up to the end of July. At present 52 applications have been received for the two years' course and 11 for the four years' course.

In certain respects the College is not well adapted to the new conditions. Especially is this so in the matter of accommodation. Sanction has been obtained for the erection of a few better class quarters, which will be available for such as desire them, at a small rent. The College farm has been increased by the addition of about 37 acres of good arable land and is now 77 acres in extent.

H. M. LEAKE,

Principal, Agricultural College, Cawnpore,
United Provinces.

Dated the 19*th July* 1915.

APPENDIX V.

Report on the Administration of the Botanical section for 1914-15 *by* H. M. LEAKE, ESQ., M.A. (CANTAB) F. L. S., *Economic Botanist to Government, United Provinces.*

Charge.—I held charge during the year under report and the post of Assistant Economic Botanist was throughout held by Mr. A. Wilson. On the 1st October 1914, I assumed charge of the office of Principal, Agricultural College, in addition to my own duties.

Publications.—In the Volume IV, part I of the Journal of Genetics appeared a paper on the Factors controlling the Ginning Percent of Indian cottons incorporating the result of work carried out on leave, and, in the Agricultural Journal of India for April 1915, a note on the Breeding of Improved Cotton in the United Provinces, giving a semi-popular account of the breeding experiments on cotton as far as they had progressed.

Research Cotton.—What I may term a second stage in the work on this crop has been commenced. When I went on leave the types had been isolated, a number of crosses had been made between these and from the off spring pure races had been selected. A few only of these were promising enough to try on a filed scale; others merely being stages in the building up of the desired plant. Crosses between these selections have now been made and will in due course undergo rigid selection.

Wheats.—The detailed investigation of the wheats of the province was completed during the year and a few selected races are to be tried on a field scale.

Barley.—This crop, which has recently come into prominence owing to the home demand, was first studied during the past rabi. In recent years a considerable trade in barley for malting purposes has arisen between India and England. Barley so shipped has been found to be very irregular in germination. Mr. Wilson undertook a preliminary series of observations to elucidate this point. These are being further developed.

Opium.—The question of the disease of the opium crop has been referred to the department and the reference has led to the study of the poppy plant. The lines of work are two; there are many gaps in our knowledge of the poppy, e.g. the extent of cross-fertilisation, full details of the method of pollination, the unit characters, &c. These will be determined as far as possible. Secondly the isolation of resistant races will be attempted, accompanying which must be a study of the cause of disease.

It seems probable that the scope of investigation on this crop may be extended since the question of the growth of poppy for morphine in place of for opium has come into prominence. At the time of writing however no definite scheme of investigation has been outlined.

Seed farm.—The season has been altogether unfavourable. The bulk of the kharif area was sown to K 7 cotton with the object of supplying pure seed of this type for distribution in Bundelkhand. This type, is not particularly suited to the Aligarh tract and this fact, combined with the seasonal conditions, produced a smaller yield than might have been anticipated. The rabi area was sown chiefly to Pusa 12 wheat. The season was again unfavourable owing to excessive humidity and the grain is thin and the yields only moderate.

Expenditure on the farm was Rs. 10,500 of which Rs. 704-10-1 was on permanent improvements. The income was Rs. 6,152-8-0. The result cannot be considered satisfactory. It is however traceable to definite causes. The rabi of 1913-1914, the produce of which was disposed of in the current year, was, for reasons given in last year's report sown too late for any but a very early maturing variety and the yield was necessarily small. The rapid fall in the price of cotton towards the end of last year again precluded the satisfactory disposal of the lint and the double effect is clear. At the same time, in view of the fact that farms like this are commonly supposed to be run on commercial lines, it is desirable to point out that this is impossible though in normal seasons a loss is perhaps avoidable.

As the Kalai Seed Farm is the earliest to be established it is as well briefly to define the reasons: —

In the first place in the general interest it is sometimes desirable to grow a crop which would not be selected if the farm returns were alone considered. An instance of this has already occurred in the cultivation of K 7 cotton during the season under report. Secondly it is not possible to take advantage of market fluctuations in the disposal of produce. Grain is for the most part taken over by other sections of the Department for distribution as seed. The rate, therefore, is regulated by the price realisable from its ultimate disposal. Lint it has been found advisable to dispose of by direct sale to the mills, who thus are enabled to handle a bulk sample and to get a preliminary idea of the value of those cottons of which the cultivation is expected to expand. In this way 11 bales of K 7 cotton has been disposed of. A small portion only of either crop is disposed of directly. Lastly a small, but appreciable, area is devoted to testing new types under field conditions. These may or may not be successful and in any case yield samples too small to be disposed of at any but nominal rates.

H. M. LEAKE,

Economic Botanist to Government,
United Provinces.

APPENDIX VI.

Report on the administration of the Chemical Section for 1914-15 *by* MR. G. *Clarke*, F. I. C., *Agricultural Chemist to Government, United Provinces.*

I remained in charge of the office of Agricultural Chemist to Government throughout the year under report. Munshi Naib Husain, Superintendent of the Sugarcane Research Station, and Mr. S. C. Banerjee, Assistant to the Agricultural Chemist (except for a short period of leave), were present on duty throughout the year.

Babu Lakshmi Shanker, 2nd Assistant to the Agricultural Chemist, was deputed to the United Provinces Sugar Co., Babhnauli, from December 15th 1914 to 28th April 1915, to carry out the chemical work connected with the factory.

The teaching staff remained unchanged except for the deputation of Babu Brij Lal Mathur, Assistant Lecturer in Physics, to the staff of the Settlement Officer, Motihari, Bihar, from the 24th October 1914.

Tours.—I spent the months of January, February and March 1915 at Shahjahanpur in connection with the research on sugarcane which is being carried out at the Sugar Research Station.

Mr. Banerjee accompanied me and also made short tours into the neighbouring districts for the purpose of collecting some varieties of sugarcane that could not be obtained locally.

I paid monthly visits to Shahjahanpur throughout the year.

The Agricultural College.—The Diploma courses of the College have been gradually expanded and made more advanced on the lines laid down at the reorganization. The students have worked well and shown interest in the chemical side of their work. Since the removal of the Qanungo classes the number of students has been smaller and this has enabled the staff to devote much more time to individual instruction. The result in the improvement of the teaching is most gratifying. Many of the students are doing quite advanced work in Agricultural Chemistry.

I continued to lecture as usual and to personally supervise the practical teaching of all classes in the laboratory. I have also prepared an advanced course of lecture on Biochemistry and its application to the practice of agriculture to meet the requirements of the advanced classes.

A course of instruction in the elementary principles of physical and chemical science with special reference to agriculture has been given to the vernacular course. This was accompanied by demonstrations in the field and laboratory.

Publications.—A paper has been published in the transactions of the Chemical Society on the organic phosphoric acids of wheat.

Sugarcane.—The equipment of the Sugarcane Research Station at Shahjahanpur is practically complete. The aim of this station at the moment is purely practical, viz. to select and propagate improved varieties of sugarcane to replace some of the present indifferent varieties in the various sugar tracts of the province.

The first step is to take stock of what the United Provinces and India already possess and to draw on other cane-producing countries where the conditions indicate that suitable canes may be looked for. Considerable progress can be reported with this work. In common with most other crops a mixture of different varieties of cane is grown by the cultivators, some of them moderately good, some extremely poor. Many of the leading canes of the United Provinces have been isolated and their chemical and agricultural characters are being studied and correlated.

Amongst the most promising of the local varieties that have been studied is one known as Reora from the Eastern districts. This has been under observation for a number of years both at Partabgarh and Shahjahanpur and a specially selected and pure stock of seed will be available in a short time for distribution.

New varieties have been imported and raised from the following countries:—

Java
Louisiana (United States of America).
Natal.
Hawaii.
Queensland (Australia).
Mauritius.
Spain.

It is not, perhaps, easy to realize the difficulty of successfully raising sugarcane from other countries. Cane is propagated by cuttings not from seed. Two or three of these cuttings have to be sent long distances by sea and rail through varying climatic conditions and frequently arrive in very bad condition. It is only by extreme care that any plants can be got through. The cane from Java and Hawaii were extremely difficult to raise.

In addition to these new varieties most of the canes that have been imported into India at different times in the past have been collected. The total number of canes under investigation is slightly over 100. Their agricultural characters are being carefully noted and their sugar content and milling properties accurately determined. Many have been carried on to a field

scale. The following table extracted from the results obtained this year gives some idea of the relative value as sugar-producers of the different varieties :—

Variety.	Weight of cane per acre maunds.	Juice expressed per 100 cane.	Sucrose per 100 parts cane.	Sucrose per 100 parts juice.	Sucrose per acre maunds.	Extraction.	Purity co-efficient.
J. 33	1,018·5	70·5	12·05	14·58	122·7	85·3	84·8
Ashy Mauritius ..	860·9	73·2	13·41	15·62	115·4	85·2	89·7
Mauritius 16 ..	745·7	72·9	11·72	13·63	87·4	84·8	85·2
Reora	680·3	62·6	10·68	12·75	72·6	74·7	83·8
Agauli	897·2	63·9	6·92	8·01	62·1	74·0	70·2
Matna	592·7	60·0	10·05	11·75	59·5	70·1	80·5
Barokha	663·4	62·1	8·62	11·02	57·2	79·4	68·8
Dikchan	594·0	67·5	9·62	11·60	57·1	81·4	76·8
Katara	560·8	66·6	9·58	11·72	53·7	81·5	76·1
Dhaul	546·7	63·6	9·60	11·66	52·5	77·2	79 3
Rokhra	560·0	60·8	8·54	10·58	47·8	75·3	74·0

J. 33, a medium sized cane that ripens early and withstands the hot west winds of May and June, is well suited for cultivation in the submontane sugar tracts of the province.

One thousand maunds of seed of this variety was distributed last year to the circle officers and is being grown in the following places :—

Bulandshahr.	Cawnpore.
Bareilly.	Pilibhit.
Aligarh.	Hathras.
Mainpuri.	Babhnauli.
Etawah.	Chanda (Central Provinces).
Atarra.	Dacca (Bengal).

Good reports are being received. Four thousand to five thousand maunds of seed will be available this year for distribution from the Shahjahanpur farm.

Mr. E. Simmons of Messrs. Carew & Co., Rosa, has interested himself in the extension of the cultivation of improved varieties amongst the cultivators of Shahjahanpur district. Sufficient J. 33 seed was put down at the factory this year to supply seed for a considerable area in the following season and it is anticipated that the extension of area will proceed rapidly. Mr. Simmons has also undertaken at considerable trouble to test on a field and factory scale other varieties and his assistance and advice have been most valuable.

Nine seedlings have been received from Dr. Barber, Sugarcane Specialist to the Government of India. Some of these have been carried through to the field scale and will be chemically examined in the forthcoming season.

Small power sugarcane mill.—A grant has been received from the Agricultural Adviser to the Government of India for experiments with a small power mill capable of crushing 10—15 tons of cane per day. Apart from the importance the question to the gur-making districts it is imperative to have such a mill at the Shahjahanpur farm in order to get through the experimental work involved in examining the canes under observation.

Mr. F. H. Vick has very kindly consented to co-operate with me in this work and the results will be published jointly in due course.

Preliminary experiments were made last year and this year another type of mill will be tried. It is, however, not easy at the moment to get the exact type of mill required as most firms state they are employed on munitions.

Other work.—The necessary sanction having been received, I acted as Examiner in Chemistry for the Preliminary Scientific Examination of the University of Allahabad in September 1914 and April 1915.

G. CLARKE,

Agricultural Chemist to Government,

United Provinces.

APPENDIX VII.

Report of the administration of Agriculture Engineering for the year ending 30th June 1915, by MR. F. H. VICK, M.I.M.E., *Agricultural Engineer.*

I have held charge of the office of Agricultural Engineer throughout the year 1914-15 and have to report very good progress. The principal work, that upon which most attention is directed, is in the line of improved wells for irrigation, in areas not touched by the canal systems of the Province. Also an endeavour is being made to introduce power pumps to lift the water from wells.

Regarding improved wells, great strides have been made in the past year with the tube-well, a form of percolation well. Several have been put down and a great many more are either under construction or on order, and it is likely that in the near future there will be a big call for them. A good tube-well will yield from 20,000 to 30,000 gallons of water per hour as a constant supply which is from 8 to 12 times as much as an ordinary pakka well and the cost is not appreciably more than the cost of a deep pakka well. We have not yet discovered an area where a tube-well cannot be sunk with success, so it is probable that in the near future this form of well will supersede the ordinary brick-lined pakka well, when new wells have to be sunk.

The year has been a difficult one in the matter of obtaining ironwork supplies, such as pipes, &c., from England, on account of English firms being full up with war orders and more progress would have been made with tube-wells but for this difficulty. Material ordered six or nine months ago which in an ordinary season would come out in two months, has not yet been delivered.

The same remark applies to power boring plant, which has been on order for a year and was to have been delivered during this one under review. It is hoped to do very much quicker borings with such plant, when it can be obtained, than by the ordinary hand methods.

I am glad to report the appointment of an Assistant Agricultural Engineer for this province. Mr. Balmokand Kapoor took up his duties as my assistant from 15th December 1914 and I have to acknowledge having received great help from him.

F. H. VICK,
Agricultural Engineer.

APPENDIX VIII.

Note on arboricultural operations during 1914-15.

New planting was done on 61 miles of provincial roads and 194 miles of local roads as compared respectively with 65 and 185 miles provided for in the working plans. Out of 194 miles planted on local roads 21 miles were planted by private individuals in Fyzabad (8 miles), Basti (4 miles), Gorakhpur (3 miles) and Muttra, Benares and Sitapur (2 miles each).

Working plans.—Most of the districts have carried out their working plans but there have been divergencies on provincial roads in 5 districts and on local roads in 11 districts. Explanations of divergencies in the case of local roads have been received from all districts except one. In four districts trees were planted in excess of the plan to make up for the deficiency of the last year's programme, in three districts funds were devoted to filling up gaps and in three districts the full amount of planting could not be done either for want of funds or young trees or scarcity of water.

Extension of avenues.—The reports received during the year show that 68 miles of "paper avenues" have been removed from the records, while 230 miles of recent planting have been added as "established."

Training class of supervisors.—The training class for supervisors opened as usual in April last at the Government Horticultural Gardens, Lucknow, is being attended by 11 students sent to it by district boards. The course extends over a period of five months during which time every effort is made to impart to these men a thorough grounding in the work of supervising roadside trees and plantations.

Financial results.—The receipts on provincial roads rose from Rs. 25,236 to Rs. 29,951, while expenditure fell from Rs. 76,289 to Rs. 76,148. The net cost to Government was thus Rs. 46,197 as compared with Rs. 51,053 in the preceding year. The expenditure on local roads was Rs. 1,26,648 or Rs. 11,499, more than in the preceding year. The receipts fell from Rs. 60,110 to Rs. 58,476. The fall in receipts is chiefly due to decreased income from the sale of annual produce.

REPORT

ON THE

Administration of the Department of Agriculture

OF THE

UNITED PROVINCES OF AGRA AND OUDH.

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REPORT

ON THE

Administration of the Department of Agriculture

OF THE

UNITED PROVINCES OF AGRA AND OUDH

FOR THE YEAR ENDING 30th JUNE, 1916.

ALLAHABAD:

PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS, UNITED PROVINCES.

1916.

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Glossary of crops mentioned in the report.

English or vernacular names of the crop.	Botanical names equivalent to the English or vernacular names.
1. Gram	Cicer arietinum.
2. Bajra	Pennisetum Typhoideum.
3. Paddy	Oryza Sativa.
4. Juar	Sorghum Vulgare.
5. Groundnuts	Arachis hypogaea.
6. Sann-hemp	Crotolaria Juncea.
7. Arhar	Cajanus indicus.
8. Bhusa	Straw (English).
9. Kharif	Autumn harvest.
10. Rabi	Spring harvest.
11. One seer = 2 lbs.	
12. One maund=82$\frac{2}{7}$ lbs.	
13. Pounda	Eating cane.
14. Khandsaris	Professional sugar-boilers.
15. Mahwa	Bassia latifolia.
16. Kapas	Unginned cotton.
17. Rui	Ginned cotton.

Report on the Administration of the Department of Agriculture, United Provinces, for the year ending 30th June, 1916.

No. 79/V—106B.

FROM

THE HON'BLE MR. H. R. C. HAILEY, C.I.E., I.C.S.,
DIRECTOR OF LAND RECORDS AND AGRICULTURE,
UNITED PROVINCES,

TO

THE CHIEF SECRETARY TO GOVERNMENT,
UNITED PROVINCES, REVENUE DEPARTMENT.

Dated Lucknow, the 24th October, 1916.

SIR,

I HAVE the honour to submit the report on the administration of the Department of Agriculture for the year ending 30th June, 1916.

CHAPTER I.

ADMINISTRATION.

Officers of the staff.

2. I held charge of the department throughout the year. Mr. H. M. Leake held the post of Principal, Agricultural College, Cawnpore, throughout the year in addition to that of Economic Botanist. Mr. A. W. Fremantle on the completion of his special duties in connection with investigations into the reclamation of ravine lands in Bundelkhand and the Agra and the Muttra districts proceeded on long leave. Mr. B. C. Burt held charge of the central circle throughout the year, with the exception of one month during which he was on privilege leave, and Pandit Nand Kishore Sharma, a member of the Subordinate Agricultural Service, held charge of current duties of this circle. Dr. A. E. Parr was in charge of the Western circle till 31st August, 1915, when his services were placed at the disposal of the Army department. Rai Sahib B. Ganga Prasad, a senior member of the Subordinate Agricultural service, was appointed to officiate for him. Mr. L. C. Sharma was in charge of the Eastern circle during the whole of the year. Mr. G. Clarke held the post of Agricultural Chemist till 7th June, 1916, when he proceeded on long leave. The services of Mr. A. Wilson, Assistant Economic Botanist, were placed at the disposal of the Government of India with effect from 21st March, 1916, and his post has not yet been filled up. Mr. W. N. Harvey, 3rd Deputy Director of Agriculture, Gorakhpur, held his post throughout the year. He also worked for a short period as a Lecturer in the Agricultural College, Cawnpore, in addition to his own duties.

3. Mr. H. F. Vick held the post of the Agricultural Engineer for the whole year.

4. Khan Bahadur Mir Saiyid Husain was my Personal Assistant till 18th May, 1916, when he went on privilege leave for two months and Babu Mohini Mohan Lal, Deputy Collector, officiated for him.

5. The experiments on the commercial prospects in sericulture in these provinces having been closed, M. Akhtar Muhammad Khan, Deputy Collector, reverted to the regular line with effect from 1st May, 1916.

6. Mr. W. Hulme, Sugar Engineer, on his return from England took charge of his duties at the Nawabganj Sugar Factory on 12th October, 1915; and

after completing the season's work returned to England on 1st April, 1916. An application has been made to Government for an extension of his services for two more seasons.

7. The department was thus left very shorthanded. Mr. H. M. Leake, the Principal, is now the only member of the permanent staff of the Agricultural College on duty. He had to undertake the teaching of agriculture in addition to his other heavy work. Mr. Wilson's transfer seriously interfered with the botanical research work. By the courtesy of the trustees of the Canning College, Lucknow, Mr. W. Youngman's services have been available for two days in the week for the supervision of the teaching in botanical subjects, and the services of Mr. J. Morphen Holt have been lent by the Educational department as Warden of the College. To carry on the work of the College, an officer to control teaching in agriculture must be appointed, and it is very necessary in the interests of the botanical research work that the vacancy created by Mr. A. Wilson's transfer should be filled as soon as practicable. It has not yet been possible to staff the new Gorakhpur circle, as none of the circles have men to spare. The weakness of Subordinate Agricultural service has been much felt during the year, but an increase in strength must wait on the improvement of financial conditions.

Development.

8. With the department shorthanded in all branches, development has been necessarily restricted. Only one new district farm has been opened, namely, at Hardoi, which is financed by the District Board; an initial grant being made by Government for buildings and equipment. Other District Boards have expressed their willingness to contribute towards the opening of the farms and seed dépôts under the supervision of the department; but, under present conditions neither the funds, nor the staff have been available. As has been pointed out in previous reports the future development of the department lies in the direction of opening more centres of working in each district in co-operation with local bodies. There is a widely expressed desire that demonstration should be localised, and easier facilities should be given to cultivators to obtain seed. These objects can be best ensured by a headquarter farm in each district from which the problems of the tract can be studied, local demonstration arranged for, and seed dépôts in easy reach of the cultivators established. It is clear that when the department is in a position to expand, there will be no lack of cordial assistance on the part of the District Boards; and there will be an additional advantage in this arrangement that the leading gentlemen of the district will be associated with the department in its work.

9. There is probably no branch of the department's work that from its inception has excited more interest than the provision of water, which in a tract, subject to periodical shortage of rainfall, is rightly regarded as the essential preliminary to the improvement of agriculture generally. After some years of demonstration, the value of mechanical means of water lifting and their relative cheapness as compared with bullock lift are becoming recognised, and, but for the difficulty in procuring plant, would have been more widely adopted. Considerable impetus was given to the movement in the western districts by the desire to put down larger areas under indigo than would have been possible had irrigation depended on bullock lifts. One zamindar in the Bulandshahr district irrigated 90 acres of his own and his neighbour's indigo from single installation, and a large pumping plant is being installed by a tank which will command some 400 to 500 acres. Looking to the ease that these installations can be put down on many of the existing wells in the western and central districts, the substitution of mechanical for human and bullock labour is likely to spread in areas outside the reach of the canals, and should materially affect cotton growing when normal prices of indigo return; the extent of the former crop being still mainly dependent on the character of the rainfall. So far, most of the pumping plant has been put down by the department; for more difficult installations, such as tube wells, the assistance of the department will continue to be required, but there is room for private firms who are prepared not merely to sell, or even put down pumping plant, but also to affect the necessary improvements in the wells by boring, etc. The department has received considerable assistance from the Pali Engineering Company, which undertakes both classes of work.

10. The number of private farms working in association with the department continues to grow. They are at present largely confined to Oudh, partly because of the absence of occupancy tenant rights and, partly because there is more waste land in that province to be brought under cultivation. One of the largest of these farms is that of the Raja of Amethi, which extends to some 280 acres, and has been formed, partly from land somewhat irregularly cultivated by tenants, but mainly from land reclaimed from jungle. Some 66 acres of Pusa 12 wheat were grown on the farms of the Raja and Kunwar Saheb. The majority of these farms were opened on large estates with the object of providing seed to tenants and demonstrating some simple improvements. On the farm of the Hon'ble Raja Rampal Singh, demonstrations of different seed r tes are given with a view to showing that the present seed rate in this part of Oudh can be greatly reduced. Some of the latest of these farms have been opened as farming undertakings pure and simple ; it is realised that, looking to the higher prices current for agricultural produce, good profits are obtainable from land, if a certain amount of capital is put into it, and some medium sized farms have been opened as commercial undertakings. A fuller account of these is given in appendix no. III.

11. The department exercises various degrees of supervision. It usually lends a trained fieldman, provides seed in the first instance, and occasionally lends implements. The farms are visited by the inspectors of the department and, so far as possible, by circle officers. The running of these farms will necessitate the employment of machinery, since it is quite impossible to carry out farming operations on any scale with the methods now in practice. Threshing operations cannot be concluded before the rains set in if the grain is trodden up by bullocks, and mechanical power must be introduced to crush the cane.

CHAPTER II.

Agricultural Education.

The Agricultural College.

12. Allusion has already been made to the reduction of the staff at the Agricultural College. This coincided with a full entry roll. The numbers at the College since the year of re-organization are given below. In the present year the College will have practically the full numbers for which there is accommodation.

31st March, 1915	...	...	...	... 53
,, ,, 1916	...	...	...	... 80
31st August, 1916	...	...	...	... 111

13. The two year course has proved, judging by the number of applicants, to be popular, and a considerably larger number of suitable candidates could be taken in, were accommodation available. As has been previously pointed out, though vernacular has been chosen as the medium of teaching, the course is a varied one, the standard as high as is compatible with the length of the course. Though it was believed that the two years' course would appeal to the landed interest in these provinces, it was not anticipated that there would be many entries for the four year, or higher course. It was intended for the class of students who look for service under Government, or a private employer, after taking their degree, or diploma, and it was made perfectly clear that the Agricultural department could annually offer very few posts. There would seem, however, to be a rather larger demand for higher agricultural education than previous experience had given reason to believe, as there have been no lack of applicants for entry to this course.

14. The first batch of students, who have taken the two years' course, pass out in October next, and their occupations after leaving the College will be a matter of considerable interest. The majority have not put down their names for Government service and will presumably return to their homes to manage their own property, or will seek employment as managers of some of the larger estates in the provinces. The latter position they are well qualified to occupy and the employment of such men by the larger landholders should not only conduce to the improvement of their estates, but will materially popularise agricultural education.

15. Certain improvements have been introduced in the College during the year. The farm has been enlarged and some new buildings erected. Arrangements have been made for a course in mechanical engineering, with the assistance of the Agricultural Engineer, and a new boarding house is under construction. It is hoped that it may prove possible at some future date to enlarge the dairy.

Horticultural education.

16. As was noted in last year's report, the overseer gardening class at Saharanpur will be closed when the remaining students pass out at the end of the year. This class has now served its purpose; it has provided a sufficient number of overseer gardeners for the public gardens of these provinces and very few students have been sent from other provinces. It is proposed to open in its place a class in fruit culture, in which there appears to be an increasing interest. The conditions of this class are still under consideration. It is hoped to attract to it men who will undertake fruit growing on a large scale either in the plains, or the hills. If fruit growing extends in the Kumaun hills, there should be openings for trained students from the gardens.

17. There is now an experimental fruit garden at Dehra Dun worked in conjunction with the Saharanpur gardens, so that practical training can be given in the cultivation of a larger variety of fruits than would be possible in a plains garden.

18. The chaudhri classes at both the Lucknow and Saharanpur gardens were kept up to their full complement, and there are a number of applicants waiting their turn for vacancies at both gardens. As in other years, there was a good demand for malis from both gardens. There were 55 applications for malis from the Saharanpur gardens, of which only six could be complied with. The entries for this class are not numerous. Malis ordinarily can obtain employment without difficulty and are unwilling to go through the course. It is thus impossible to meet the applications for properly trained men. Some Indian gentlemen have adopted the practice of sending men to be trained at the gardens with satisfactory results.

CHAPTER III.

Research and Experiments.

19. Both research and experimental work have been necessarily handicapped by the shortness of the staff, in particular by the transfer of Mr. A. Wilson, the Assistant Economic Botanist, which left Mr. H. M. Leake single handed to deal with the somewhat numerous problems now under investigation. It was pointed out in last year's report that the scope of the investigations in connection with poppy has been extended, and the main object now is the improvement of the morphine content of the opium produced in these provinces. As a first step it was necessary to isolate pure races of poppy. The seed of these races is now available for further investigation, and comparative tests and experiment to elucidate certain points regarding the suitability of different tracts and different methods of cultivation will be taken in hand.

20. In other crops experimental work is further advanced and can be most appropriately dealt with in an account of department's work on individual crops.

Cotton.

21. The year was not a favourable one for this crop; in the first place sowings in 1915 were short, owing to the indifferent prices obtained in the previous year, and amounted only to 8,21,059 acres, as compared with 15,32,132 acres in the previous season. Again, the rainfall over the part of the provinces was excessive for this crop, and in some of the central districts it had done so badly by September that the ground was ploughed up and prepared for the rabi. Prices improved when the crop came on to the market and there was a renewed interest in crop of 1916, but a considerable area normally under cotton was put down with indigo. In June of this year when the early rains fell, the demand for seed was intense and the whole of the available stock of the department was sold off within a week.

22. The areas in which Cawnpore American cotton are mainly grown were visited by serious floods, and a certain portion of the crop was destroyed. The outturn was smaller than in the previous year and the quality was not all that could be desired. The lint was taken over by the Muir Mills of Cawnpore and

prices realised were good, permitting of a premium of about Rs. 2 per cotton maund of *kapas* over *deshi* being paid to the cultivators. In the current season sowings were restricted by the serious shortage of water in the canals; though a somewhat larger area has been sown with "buri" cotton in the western districts. Several zamindars have arranged to start gins for dealing with the produce and, as the demand for this cotton appears to be good, cultivation should extend. The spread of American cotton has received serious set backs of recent years in the shape of the slump in prices, widespread flood and a shortage of water at sowing time. On the other hand it may fairly be said that the market has been established for it at prices profitable to growers. Since, to obtain the best results, it must be sown with the irrigation before the rains, the area of its cultivation in these provinces is comparatively limited; but within these areas there is clearly a place for it, provided suitable arrangements can be made with the Irrigation Department to provide water at sowing time. On certain lines of canals the people have become accustomed to growing this type of cotton and, if assured of water, would grow it in larger quantities.

23 Mr. Leake's new types, such as K. 22, stand on a rather different plane. They are the outcome of a definite effort to improve *deshi* (G, neglectum) rather than to substitute another variety for it. K. 22 is a hybrid with a better lint than the ordinary *deshi* and, so far as can be judged, with as high a yield and ginning percentage. Having the same habit as *deshi*, there is no reason why this, or some similar cotton, should not take place of the former over the wide areas in which this is the only type which can be satisfactorily grown. In the present season, where sown on the rains it appears to be quite as advanced as Aligarh white flowered. Last year no fair trial could be given, but about 100 maunds of seed have been distributed this year and a better idea can thus be formed of its qualities. Some conception of the relative value of this cotton can be gathered from the fact that with *deshi* at Rs. 25 per maund, the lint of K. 22 sold for Rs. 31, while American fetched Rs. 36.

24. Aligarh white flowered continued to be a very popular cotton; in consequence of the opening of the district farms in the Agra and Muttra districts, it is spreading rapidly in these areas. These two districts took over a thousand maunds of seed. It has, however, always been made clear that while a heavy yielder—at the Muttra farm last year the crop averaged over 450 lbs. of lint per acre—with a high ginning percentage, it is essentially a short, coarse staple cotton. Before the war, it commanded a ready market on the continent and Japan; and from the cultivator's point of view, it is a more profitable crop than ordinary *deshi* over which its *kapas* received a premium on account of the ginning percentage. It is not, however, certain that this class of cotton will always command the same market and a *deshi* cotton with a finer and longer fibre would be more popular with the Indian Mills.

25. The owners of provincial baling presses have agreed to submit fortnightly returns of cotton baled which have been regularly published during the ginning season. I should like to acknowledge the ready assistance they have given.

Sugarcane.

26. Though the two crops compete to some extent in the Meerut division, the sugar growing tracts, in the main, are entirely distinct from the cotton growing and the unpopularity of the latter crop did not affect the area under cane. Sowings of cane depend largely on prices of *gur*, which have been high since the war began, and more attention is being paid to the crop. It certainly deserves it, as, except in the Meerut division, there are few crops so generally neglected in these provinces. The department may be said to have made a definite step forward in proving the suitability to these provinces of a cane of medium thickness, which, with proper cultivation, is capable of giving a yield considerably superior to the indigenous cane. A full account of the results of the working at the Cane Research Station, Shahjahanpur, are given in bulletin no. 35 published by Mr. G. Clarke, the Agricultural Chemist. One of the most important of these is to corroborate what had been observed at other farms, namely, that there appears to be a definite limit to the yield of sucrose from most of the indigenous canes. Heavy manuring with nitrogenous manures appears merely to give rise to an excessive vegetative growth without any proportionate formation of sucrose. This is

amply confirmed by the returns over a series of years of the yields of indigenous canes grown on the different farms. There is a limit observable in the outturn of gur beyond which they do not seem to yield, though the crop in weight of cane may be a heavy one. The figures quoted by Mr. G. Clarke of a comparison with "Reora", one of the best of the provincial canes, and two canes recommended for growing are worth reproducing.

Variety.	Yield of cane per acre.	Yield of sucrose per acre.	Sucrose per 100 parts of cane.
	mds.	mds.	
J. 33 ...	723·2	84·4	11·67
Ashy Mauritius	779·8	105·9	13·58
Reora ...	785·9	55·2	7·03

27. The conclusion drawn from these results is that to increase the yield of sugar per acre in Upper India it is necessary to improve methods of cultivation, and also to introduce improved varieties. The former are modifications of present practice and necessarily involve some additional expenditure over existing methods, but they are not beyond the means of the better class of cultivators. One of the two canes found most suitable at Shahjahanpur, namely, Ashy Mauritius, has proved somewhat too delicate for general distribution, though it has become popular as a *pounda*, or eating cane. A full account of J. 33 is given in an article appearing in the July number of the Imperial Agricultural journal, together with the results obtained at the Rosa factory in the Shahjahanpur district. The results of the test of this cane made at the factory are shown in Appendix VI. At the Tamkohi factory in the Gorakhpur district there were some 80 acres under two well-known Java varieties of cane which did well in the field, and had notably higher sucrose content than the thin indigenous cane of the factory.

28. It has long been recognised that for improvement of the sugar industry the introduction of medium sized cane in place of the small thin canes of the provinces is desirable. Mr. McGlashan who has wide experience of sugar making in Upper India, writing some years back, stated "Most of the canes grown by native cultivators are of a poor quality and have only their hardy qualities to recommend them. There are also medium sized varieties of canes grown near towns, highly cultivated and well irrigated, which yield an excellent juice in every way. Sugar content is good and they are easily worked in a factory. At present they are mostly grown for eating." Most of these canes require higher cultivation than the cultivator is prepared to give and are specially selected for softness of the rind which makes them suitable for chewing. J. 33 is a hardy cane and appears to have qualities to recommend it as a medium sized variety for general introduction. It bears a marked resemblance to a class of cane found throughout the provinces, and on this account is more readily adopted by the cultivators. Such canes, however, will not stand a treatment ordinarily given to thin canes in the submontane districts; 45 per cent. of which are unirrigated, and receive little or no manure. Some demonstration plots have been opened to show best methods of cultivating improved varieties of cane.

29. The great possibilities of improvement were clearly brought out by weighments of cane grown in cultivators' fields, which were bought for the sugar factories in the Bareilly and Pilibhit districts. In the former, the average produce was only 200 maunds per acre and in the latter, below 300. With this may be compared the yield of six to seven hundred maunds obtained at the Rosa factory, and it is understood that at Tamkohi in the Gorakhpur district somewhat better yields were obtained. Taking the above figures of average outturn and calculating the extraction of crystalline sugar by native methods at 3 per cent. which appears to be about the average, as compared with the Java extraction, it has been estimated that one acre in Java produces as

much as 14½ acres in the United Provinces. It is easy therefore to understand why, with a total acreage of 300,000 acres as compared with a million and a quarter in these provinces, that country supplies us with most of our crystalline sugar. It must be admitted that much of the sugar growing land of the United Provinces is to be put to a very poor use.

30. Owing to climatic conditions the yields per acre of cane in the United Provinces are not likely to equal those of Southern India or Java. But it has been abundantly proved that they can be improved at no great cost, and the future of the sugar industry seems to depend on this crop receiving some measure of the careful attention devoted to it in countries where industry has been successful. It is sometimes suggested that, as these provinces lie outside the recognised sugar growing tract, cultivation might with advantage be left to those parts of the world more favoured climatically. But on the same line of argument our fertile plains would be left largely uncultivated; for it is difficult to point to any crop for which this tract, with its short growing period and extreme vicissitudes of temperature, is eminently suited. Certainly the argument would apply in a greater measure to cotton, which, in normal years, after struggling through a deluge of rain, must produce its fruit in the short period before the cold weather sets in and cuts short ripening. For wheat, too, a longer growing period than 4 to 4½ months cannot be counted on before the hot winds begin. But the tract has an advantage of open, easily worked soils which respond readily to light manuring and ample water supplies. With these advantages medium yields of cane from 20 to 30 tons per acre can be produced in sugar growing areas at a moderate expense; even now larger yields are annually produced with intensive cultivation near large towns.

31. On the mechanical side the experimental sugar crushing plant at Nawabganj, Bareilly, designed by Mr. W. Hulme, Sugar Engineer, was worked as long as cane was available. Most of the cane in this neighbourhood was sold in advance to *khandsaris* for 'rab', and only a small supply could be procured. A full account of the plant together with the results of its working has been published by Mr. Hulme. The plant is designed on the smallest scale which in Mr. Hulme's opinion can be worked on a commercial basis. It is believed that an extraction of 6 per cent. can be obtained which, taking into account small initial cost and low expenses of working, would return a fair profit. As in some years it would be more profitable to make *gur* than sugar, the plant is designed for both purposes. The growth of farms in Oudh will compel growers to use mechanical power in place of the bullock driven mills, the expression of juice from which is extremely slow. The mill designed by Mr. W. Hulme should suit larger growers, but the more immediate demand is for a crushing mill that can be used with the oil engines purchased for water lifting and other farm purposes. A plant, which has been tested at Shahjahanpur and found to give a fair extraction of juice, is being made by a local firm and will be tried more fully in the ensuing cold weather. It is not professed that the juice extraction will be better than that of a three roller mill, driven by sufficiently powerful bullocks to work it. But such a plant will permit of the crop being crushed within the time available, and will set free the bullocks which are urgently needed for agricultural work at this season of the year.

Wheat.

32. The work on wheat was confined mainly to the systematic introduction of Pusa 12 into Oudh, the Benares and Allahabad divisions. The trial of other varieties was made in the submontane districts, the conditions of which are dissimilar. Arrangements were made by Mr. B. C. Burt, in conjunction with the Imperial Economic Botanist for a trial shipment to establish this wheat on European market and obtain special rates for it. A shipment of 200 tons was made to England and the results will be published in due course. The cultivation of this wheat is spreading over Oudh through the agency of private farms and Co-operative Societies, and its exclusive cultivation would greatly facilitate the establishment of special market for it at higher rates than *deshi*. In the Upper Doab it has to contend on a better class of wheat than in Oudh. But the two previous years, one marked by rust and the other by shortage of water, have brought out its points of superiority as an all round wheat and it is making a good headway. To raise the general

level of provincial wheat, it is obviously desirable to concentrate on one wheat of good market quality and its substitution for the mixed local races is accordingly being pushed on. For the irrigated parts of Bundelkhand an earlier wheat is more suitable and in these tracts Mr. Burt is distributing Pusa 4 and a wheat with somewhat similar habit produced by Mr. Leake at Cawnpore. Another line of work on which the department is engaged in connection with wheat is the demonstration of the possibility of lowering the seed rate in the South Oudh and adjoined districts. The rate in these areas has always been high—generally above two maunds—and the class of seed used particularly poor. It was for this reason that the first seed dépôts were opened in this tract; but the purpose in view was not entirely fulfilled, as wheat chosen for distribution, namely Muzaffarnagar, was too late for the tract and required more water than can be commanded from the wells. With Pusa 12, operations have been greatly extended and demonstrations are being given that with reliable seed equal results can be obtained from a much more moderate rate of sowing. In this matter great assistance is being received from the private farms, where placards are placed in the fields showing the different rates of sowing. The lesson is one fairly easily learnt and the ultimate result should be the saving of a good deal of money to the cultivators.

Indigo.

33. The heavy prices realised last year for indigo induced many zamindars throughout the Doab to repair their old factories, and make arrangements for growing the crop among the neighbouring cultivators. Last year sowings were restricted by the scarcity of seed; this year the seed supply was sufficient, though mixed with Sukkar seed from the Punjab. Water in the canals was, however, short and part of the seed could not be sown. It is probable that the total area will not be under 150 thousand acres, as compared with 46 thousand of last year A stock of pure seed was purchased and made available for growers. Arrangements were also made for growing Java Natal seed for Bihar, but sowings were not on as large a scale as was hoped, owing to the shortage of canal water. Sown early, the plant in these provinces sets seed before the cold weather.

Groundnuts.

34. The growing of this crop is spreading without further demonstration, and, beyond supplying seed to growers who wish to renew their stock, it was not necessary for the department to take any special action. It is however grown mainly for eating purposes, and its cultivation is for the most part confined to the vicinity of large towns, where it is becoming popular as an article of food. Growers have discovered that it does well on light, poor soils, with the result that a lot of light land is being broken up for its cultivation. This is very noticeable round Lucknow where the considerable area of light sandy soil, irregularly cultivated, is being put under the crop. At present up country prices, namely Rs. 5 per maund, it is a profitable crop; an average yield being some 25 maunds per acre. It is difficult to estimate expenditure, as the main cost lies in the harvesting which is carried out by the cultivator and his family. No separate column being provided for it in the land records, the total area is not ascertainable.

Other crops.

35. Mr. B. C. Burt's selected *juar* seed and early ripening *arhar* were in request. Measures were taken for maintaining a supply of potato seed in the areas infested by the potato moth.

CHAPTER IV.

ASSISTANCE TO THE PUBLIC.

Distribution of seed.

36. The provision of seed continues to take up much of the time of the officers of the department—in fact it is no exaggeration to say that it absorbs much of their time to the exclusion of other equally important duties. In the absence of any large seed farms, the bulk of the seed is grown by selected cultivators and bought back from them, being then retailed towards harvest time to small men cultivating only a few acres. This involves supervision over the growers' fields to see that no mixtures have crept in and a number of transactions, mostly on a petty scale. It also throws a heavy burden on the clerical staff, accentuated by an audit

system not intended for this class of work. Some idea of the extent of these transactions can be drawn from the fact that in the Eastern circle only 16,343 maunds of seed were taken by growers, few of whom purchased more than a couple of maunds. In the above circle, there are 14 seed dépôts managed by the department and four by District Boards, which are supplied with seed for sale. The demand for seed remains greatly in excess of supply, and, though organisations such as Co-operative Societies now render assistance, few of those can stand on their own feet and require constant supervision by the officers of the department; while the majority still look to the department for providing the seed. Owing to the small size of holdings in these provinces, seed farms are difficult to establish. Some of the larger landlords in Oudh have established farms with the special object of supplying seed to their tenants, but this only meets the demand in local areas. The burden of meeting the demand is likely to remain for a considerable period on the shoulders of the department, and can only adequately be met by large seed farms which will simplify operations by doing away with the necessity of arranging for growing through a number of small men. Further, it is obvious that unless there is some central seed supply of this nature, there is great difficulty in keeping new varieties pure. The principal items of seed distributed are shown in the appendices to this report.

Sale of implements.

37. There was somewhat smaller demand for the implements than in previous years, probably owing to higher prices. Ploughs as usual were mainly in request, and more chaff-cutters and kibblers were sold. Arrangements are being made by which some of the principal Co-operative Societies will sell implements supplied by a leading firm of makers on commission. A grant has been made by the Irrigation department to popularize the use of lever harrows in canal tracts, with a view to reducing excessive consumption of canal water, which is closely connected with a deficient tillage of the soil during the cold weather months.

Manures.

38. While there is ample evidence that intensive cultivation is spreading in the growth of the areas under potatoes, garden crops and eating cane, yet the fact remains that it is still largely confined to the neighbourhood of big towns, and there are wide tracts in which the yield continues to be unduly low. The poor outturn of cane is a case in point. Improvement to some extent depends on the wider application of manures. It is not, however, merely a question of pointing the advantages of manuring with which cultivators are fully acquainted, but also of bringing to their notice the value of the particular manurial agencies and organizing a regular market for them. Nitrogenous manures being mainly required, the most promising appear to be various forms of cakes, both from the point of view of their fertilizing quality and initial cost. Castor cake is used in certain parts of the provinces, notably Farrukhabad, for garden crops. But there is no regular market for it and prices fluctuate greatly. With a view of encouraging the oil crushing industry, the Board of Industries recommended a grant in aid for popularizing oil cakes, since the main obstacle of the growth of trade has been the difficulty of procuring a sale of the cake. The grant of Rs. 5,000 made for this purpose was mainly devoted to the purchase of *mohwa* cake (from the crushing of *mohwa* seed) which was distributed primarily among cane growers. This cake contains $2\frac{1}{2}$ per cent. of nitrogen as against $4\frac{1}{2}$ in castor cake, but being obtainable at much lower rates is comparatively cheaper. The reports regarding it are satisfactory, and the Deputy Director, Western circle, reports that cultivators who have used it are pleased with the results.

Nim cake is another valuable cake for manurial purposes, but the oil is going out of use as an illuminant and, except for purposes of adulteration, does not appear to be widely used. As it is one of the cheapest vegetable oils, some investigations to remove the pungent taste might prove commercially profitable. When regular supplies are available and the value of these cakes is more widely appreciated, their sale with advantage might be taken up by the Co-operative Societies. There is probably some truth in the assertion frequently made that the yields of wheat have declined in the Doab with the decay of the indigo industry and loss of the valuable seeth: from this point of view the revival of the industry may have useful indirect results.

Fruit.

39. The fruit garden near Chaubattia is being fully planted up and nurseries started for the provision of young stock. The Forest department are making arrangement for the regular supply of wood for packing cases. The most pressing problems of fruit growing in the hills are transport problems. This may be gathered from the fact that the owner of one of the largest orchards calculates that when his orchard is in full bearing it would require 300 coolies daily to remove the produce to the nearest railway. Until this problem is solved, it is not easy to see how the industry can greatly expand. Fruit bottling has been carried on a small scale in the Government gardens, but the provincial glass making industry is insufficiently advanced to manufacture the bottles required and it is difficult to procure them from abroad. With an adequate supply of bottles, a profitable method of getting rid of a class of quickly perishable fruit would be opened up.

Well boring.

40. In pursuance of the scheme for re-organizing the work of the well department, borers were withdrawn from districts in which it had become clear that little success was being obtained by existing methods, and the remainder concentrated where working conditions are easier. The total number now employed in districts is 47 as compared with 60 in 1913, six borers being definitely transferred to tube well work. Though a few are still retained in the submontane districts, they are mainly engaged in finishing work in hand ; and the number will either be further reduced, or made over to the Agricultural Engineer for special employment.

41. Another step has been the placing of a certain number of borers under the circle officer in areas where no particular engineering problems arise. This enables the circle officer to carry out sufficient improvements in existing wells for the installation of oil engines. In the submontane districts, large portions of the Agra and Allahabad divisions and Bundelkhand this is rarely practicable, and the improvement of the water supply in these areas involves problems which can only satisfactorily be dealt with by the Agricultural Engineer. In those parts of the provinces where a clay foundation with underlying water bearing sand is regularly met with at no great distance from the surface, the present class of borers have proved useful in improving existing wells ; but, outside these areas, wells are not susceptible to improvement by the same comparatively simple methods and a good deal of energy has been wasted.

42. The total number of borings of existing wells amounted to 667, as compared with 1,185 in the previous year, the falling off being attributable to the withdrawal of borers from the submontane districts and the scarcity of plant which hampered operations. Four districts, viz. Lucknow, Rae Bareli, Etah and Aligarh account for nearly one-third of these borings. 272 trial borings were made for wells, of which 193 were returned as successful. There was a scarcity of water for drinking purposes in the Jhansi district, and the blasting overseer is reported to have done useful work in deepening wells on rock beds.

43. An interesting experiment was carried out by Chaudhri Rai Amar Singh Bahadur in the Bulandshahr district of pumping water from a pipe sunk through the clay foundation without the construction of a well. After the initial difficulties from the rising up of the sand were overcome, a heavy discharge was obtained, which increased as the cavity enlarged. The pumping installation was worked throughout the cold weather by the chaudhri Saheb for the benefit of the adjoining villages. Two more similar installations have been put up in the Etah and Bulandshahr districts. They appear suitable for those parts of the provinces where water is found near the surface under a suitable clay foundation, and the money which would otherwise be spent on the well can be devoted to the purchase of the engine and pumping plant. There has been a steady demand for oil engines for pumping purposes in the Upper Doab, and it is extending to those parts of Oudh where similar subsoil conditions are met with. But plant has been source and expensive.

44. A special staff of borers was placed at the disposal of the Collector of Muttra with a view to obtaining sweet water by deeper borings in brackish tracts of the district and improving the supply where the water level has fallen. The limit of canal irrigation has been reached in this district and, owing to the thickness of the clay beds, the common form of wells are expensive to construct

and rather uncertain: the most feasible method of protecting this precarious area seems to be by deep tube wells.

Agricultural Engineering.

45. An account of the working of the Agricultural Engineer's department is given in Appendix no. VII.

Operations have been considerably hampered by the scarcity and high cost of material of all descriptions; but, in spite of this, some 30 tube wells have been put down during the past two years. Applications for others have been received which would keep the department at its present strength occupied for some years to come, but under existing conditions only a portion can be complied with. Some of these have been put down for demonstration purposes in particularly precarious tracts, such as the Muttra district and the *bhur* tract of Budaun; a few for the Government farms, or gardens and the rest for landlords. Two of the former, viz., those in Hardoi and Budaun districts, will be made over to Co-operative Societies as soon as the necessary arrangements can be made for distributing channels and realization of fees.

The power boring plant purchased from an Australia firm was worked during the cold weather, and should prove a marked improvement over present hand methods of boring. One promising development is the improvement of percolation wells in the submontane districts by the addition of strainer tubes. There are many zamindars, unwilling to bear the expense of a large installation worked by an oil engine, who would willingly meet the cost of an improvement of their wells if they could be made to bear the working of, say, two to four charsas with bullock lift. Some trials are being made and, if successful, seem likely to solve the vexed question of improving these percolation wells which, resting on sand, at p esent give a minimum discharge. In addition a beginning has been made towards utilizing the smaller perennial streams and deep tanks of the provinces. Two installations have been put up on the Gomti, and another by the side of a large tank in the Etah district.

CHAPTER V.

MISCELLANEOUS.

Co-operative Societies.

46. Relations with these societies continue to develop, especially in the Central circle. As will appear from the account given in Appendix II, an appreciable number are engaged in seed distribution. A few of the larger are making their own arrangements for growing seed through selected members and storing it till harvest time. This involves an initial outlay and a certain amount of risk which only the wealthier societies are in a position to incur. The majority are employed as distributing agencies for seed supplied by the department. Operations of this nature are necessarily limited by the inadequate supplies of seed available. Some of the manurial cake procured from the Government grant was distributed through societies; it is hoped that, as the demand spreads, the sale of cakes which should prove a profitable business involving little risk may be regularly undertaken. The same applies to the sale of implements on commission. Special interest attaches to the pumping schemes under the co operative management: it would clearly greatly strengthen the position of a society if commanding the water supply in a dry tract. Present experience goes to show that it is better that the installation should remain in the hands of the department for some little time, until initial difficulties of arranging the water channels and accustoming the cultivators to take water regularly are overcome.

Court of Wards estates.

47. The department has received much assistance from various Court of Wards estates which it is desired to acknowledge. Some of the larger estates are now taking over the entire arrangements for supplying seed to their tenants and conduct the demonstrations of varieties recommended. Mr. Burt writes that without assistance of the Special Managers in the Sitapur and Kheri districts it would have been impossible to carry out any appreciable amount of work in these districts, owing to the shortage of staff. The Court of Wards, Rae Bareli, was equally helpful.

Agricultural exhibitions.

48. There were sixteen agricultural exhibitions held in different parts of the provinces. So far as funds permitted different forms of agricultural machinery and implements were

exhibited. An annual grant is made for prizes for agricultural exhibits which is supplemented from the exhibition funds, and at many of these exhibitions there was a good show of produce.

Fieldman staff.

49. The system of employing fieldmen is working satisfactorily and some of the men have been placed in charge of departmental farms, or have been lent to manage private farms. The best of them are from Jat regiments; these men are born agriculturists and are excellent at controlling labour. Training is also given on the farms to servants of private estates.

Receipts.

50. The total receipts of the year (which do not include receipts from the rabi of the current season) amounted to Rs. 81,684, as compared with Rs. 77,344 in the previous year. As there appears to be still some misunderstanding on the subject, it is necessary to repeat that neither the experimental nor demonstration farms are run for a profit. Even the seed farms cannot be run on a commercial basis. In selecting the crops to be grown, those for the seed of which there is the largest demand have to be put down, not those which will give the best returns. The cultivators of these provinces have not yet been educated up to paying a premium for good seed, and the department has to sell selected seed at grain rates, which is not a profitable undertaking. Moreover as any profits from these farms must come from the cultivators and not from the consuming public, it does not appear desirable, even if it were possible, to make any considerable profits at their expense. All that can be aimed at is that these farms should pay their way; and this, as will appear from the accounts given in the appendices, they do comfortably. The Shahjahanpur research farm returned receipts at Rs. 7,200, against expenditure of Rs. 7,500; the produce being sold chiefly for seed at prices which would cover expenditure.

51. Mr. L. C. Sharma has been at pains to collect information regarding the profits on the private farms, which are run in conjunction with the department and on which crops recommended as most profitable are exclusively grown. The accounts of some of these farms are shown in Appendix no. III, and in all cases they show very satisfactory returns. The model farm alluded to could not be got in working orderlast season, as the pumping plant was not up in time for the proper irrigation of the rabi crop. In some other cases, too, there was delay in getting up the pumping plant, and the season being dry, the crop suffered in its early stages.

Demonstrations.

52. It is usual in this report to give some account of the demonstration work of the department. The object of the demonstration work undertaken by the department is to show that by seed selection, more careful and intensive cultivation, the use of better implements and machinery the productivity of the soil can be increased. It is not however separate branch of the department's work: it enters into every part of it. The lessons are enforced as much by the seed distribution operations, or even the engineering work as by the actual demonstration plots. The latter are useful in demonstrating the value of some particular crop, but the idea that a demonstration farm can show in a compendious fashion all the methods of improved agriculture is somewhat fallacious. The ordinary agriculturist is essential imitative and is guided by the successful experience of his neighbour and not by precept. The measure of success of the educative work of an agricultural department is to a large extent the influence obtained over the smaller number of enterprising individuals among the agricultural community.

General.

53. It is unnecessary to labour the point that the department has expanded beyond the strength of the staff, which was fixed at a time when the present developments, particularly the incessant demand for seed, were not contemplated. Without the appointment of fieldmen it would have been difficult to keep things going. The need most immediately felt is for officers of superior grade to relieve the circle officers, who are becoming immersed in routine work, and have insufficient time for touring in their circles and supervision of the smaller farms. The form in which this assistance can best be given is suggested by the example of the Civil Veterinary department, where the appointment of Deputy Superintendents has been attended with good results.

Agricultural publications.

54. The following bulletins were issued during the year under report :—

Bulletin no. 34 Brochure on the school gardens by H. J. Davies, Superintendent, Government Horticultural Gardens, Lucknow.

Bulletin no. 35. Notes on improved methods of cane cultivation by G. Clarke, Agricultural Chemist to Government, United Provinces, and Naib Husain, Superintendent, Sugarcane Research Station, Shahjahanpur.

The vernacular papers and pamphlets issued and articles written for the Agricultural Journal of India during the year under report are detailed in Appendices II, III and VI.

I have the honour to be,

SIR,

Your most obedient servant,

H. R. C. HAILEY,

Director.

APPENDICES.

APPENDIX I.

Report on the Administration of the Western Circle of the Department of Agriculture, United Provinces, for the year 1915-16 *by* RAI SAHEB BABU GANGA PRASADA, *Officiating Deputy Director of Agriculture.*

The circle was in charge of Dr. A. E. Parr, the permanent Deputy Director up to 31st of August, 1915. He joined the military department on the 1st of September, 1915, from which date up to the end of the year under report I have been in its charge. As reported in the previous year the circle has agricultural stations in the following districts :—

1. Aligarh.
2. Bareilly.
3. Agra.
4. Muttra.
5. Bulandshahr.
6. Saharanpur.

District work.—The demand for the white flowered country cotton seed was much more than in the previous year. We had collected 1,425 maunds of its seed for distribution. All of it was issued by the time the season for its sowing commenced. Many indents were afterwards refused and the people had to go back disappointed not getting the seed. The pressing demand for this seed was in the district of Agra and Muttra where it has gained popularity through our demonstration Farms, which are also the seed distribution centres for those districts. In order to meet the demand most of the seed from stocks at Aligarh and Bulandshahr had to be sent to the Agra and Muttra centres yet the supply proved insufficient for the demand.

The produce of the Buri cotton raised by the cultivators from the seed supplied by the department last year was purchased. The 'rui' (ginned cotton) was sold to the Muir Mills, Cawnpore, while the seed was kept for re-distribution. The mills paid for the 'rui' at Rs 36-4-0 per imperial maund. This was valued according to the standard price of Middling American in the Liverpool market.

At the time when the price of Rs. 36-4-0 was paid by the mills for Buri, the white flowered country 'rui' of the best quality fetched Rs. 23-8-0 per maund in the Aligarh market, thus the difference in price was Rs. 12-12-0 per maund. No doubt the ginning percentage of Buri is less than the white flower country cotton but the increase in price for the quality of lint and staple not only compensates the deficiency but leaves a margin of profit. This fact was explained to the cotton growers by means of specially made diagrams and pamphlets in the agricultural courts of the district exhibition which aroused the interest of the cotton growers for growing the Buri cotton where early sowing can be done with irrigation from canals and wells. After disposing of the Buri 'rui' some profit was left in my hands. This profit was distributed to the growers as bonus, which gave further stimulus for the extensive cultivation of this cotton.

Seed centres were opened in charge of the agricultural Inspectors and efforts were made for the extensive cultivation of this cotton. Consequently 170 maunds of the seed were distributed enough to sow about 1,000 acres. But I am not sure if all the seed distributed has been actually sown on account of the reason that the high price of indigo induced the cultivators to sow indigo first as much as they could with the water supply available from canals and wells. After sowing indigo which occupied most of the season on account of deficient supply of canal water they turned their attention to the Buri cotton. At least half the quantity of the seed supplied is estimated by enquiries to have been put in the soil. Most of it is in the canal irrigated area in the tahsil of Sikandra Rao, district Aligarh and some on the area irrigated from well by means of oil engine pumping installation supplied by the department in the district of Bulandshahr and Etah. As there is no ready market for the purchase of this cotton at a reasonable price I am arranging to buy back the whole outturn, gin it and dispose of the rui (ginned cotton) as in previous year allowing the profits gained to the growers to encourage them to grow it on a larger scale next year.

Four double roller gins have been provided for ginning the produce by the oil engines near the pumping installation where this cotton has been grown. The rest of the produce will be brought to a central ginning factory at Sikandra Rao to meet the convenience of the growers.

Mahua cake as manure.—A sum of Rs. 1,000 was received from the Board of Industries for popularizing sale of manurial cake. Mahua cake with this money was purchased from the Premier Oil Mills, Cawnpore, and distributed gratis to the well-to-do cultivators and Zamindars in the districts of Etah, Aligarh, Bulandshahr, Meerut and Muzaffarnagar, with particulars printed in the form of a notice regarding its use, cost, etc., recommending it for sugarcane.

The price of this cake when bought in bulks from the above mentioned mills is small but the freight from Cawnpore to various district, in the western circle is prohibitive. The cake can be used with advantage near about Cawnpore.

Sugarcane.—The Aligarh, Bareilly, Muttra and Bulandshahr farms distributed sugarcane seed specially of the Saretha variety in large quantities. Other provincial varieties which proved better than the local ones were also distributed from the Bareilly and Muttra farms. Thick canes were chiefly distributed from the Bareilly and Bulandshahr farms for seed. J. 33 was distributed in small quantities from Bulandshahr and Bareilly farms. The details of the seeds distributed from the various farms are given in a statement (appendix A). The provincial white varieties of sugarcanes chiefly the Reora, Himja, Kuswar and Dhaur are in great demand from the Bareilly farm on account of their high sugar yielding quality. Arrangements have been made to sow them on as large an area as possible. The system of planting only the tops as seed in Rohilkhand allows the advantage of using the cane for sugar manufacture and unlike in other districts where the tops are not separated in crushing and in planting the whole cane

is cut into pieces and sown, the other advantage is that the seed once introduced is not destroyed, rather, it goes on multiplying every year. Thus it is easier to introduce new canes in Bareilly than in other parts of the circle where tops alone are not used as seed and a quick improvement should therefore be expected in the introduction of the better varieties of sugarcanes round about the Bareilly farm which will be a boon to Mr. Hulme's sugar factory put up at this farm as well as to the local khandsaris.

Wheat.—Pusa 12 wheat was in great demand and 1,945 maunds of it were supplied for seed from the various farms in the circle. 385 maunds of Muzaffarnagar wheat and 95 maunds of other varieties were also supplied for seed. Some growers have preserved their produce of the Pusa 12 wheat for us which we will supply for seed at the next sowing season. The sale proceeds will be handed over to them. This is a sort of beginning for establishing private seed preserving and distributing centres. No Government money has been invested this year in stocking wheat seed. The wheat produced at the various farms is in stock for seed supply.

Gram.—Pusa 5B yellow gram has been found to give a better yield of grain. One hundred maunds of it were supplied for seed. In the year under report the work of the pumping installations was carried out more extensively than in the previous year. Unfortunately on account of the war engines could not be had from the makers in England and most of the indents were therefore refused. The work of giving assistance to the persons who have got the installations, was fully maintained through the mistris and mechanics kept for the purpose.

The new system of putting down tube wells of ordinary 6" plain pipes dispensing with the sinking of masonry cylinders below the percolation level for pumping water with the oil engines has been a marvellous success in the districts of Bulandshahr and Etah. Further improvement to this system is being worked out in the way of connecting the tube wells direct with the pump dispensing with the suction pipe.

Agricultural shows.—During the year under report special attention was devoted to the Tigri, district Moradabad, Aligarh and Bulandshahr shows.

Experimental work at Aligarh.—At Aligarh the investigation of cotton, wheat, sugarcane, maize, groundnuts, arhar and juars was carried on as in past years. The trial of cottons received from the Economic Botanist and those of the American and country varieties was continued. The work of plant selection of cottons was also maintained. The seed obtained by plant selection has been sown on a large scale.

Variety test with wheat was carried on and the Pusa wheat no. 12 and Muzaffarnagar again proved their superiority. Different systems of cultivation and manuring with wheat and cotton were studied. In the green manuring test with wheat cowpeas gave better returns than sanai. A large number of varieties of sugarcane and groundnuts are under trial. Cane no. J. 33, J. 36 and Uba besides the saretha which is now the well established superior variety for gur production have given very promising results. The Farm has been an important centre for the supply and supervision of the pumping installation for the district of Etah, Agra, Muttra, Aligarh and a part of Bulandshahr. It has also been a centre for stocking and distributing the cotton and wheat seeds on commercial scales.

Nawabganj (Bareilly) Farm.

The chief experiments are:—

I. Sugarcane—

1. Comparison of different varieties of thin and thick canes.
2. Trial of thin canes with green manuring alone as well as in combination with different quantities of manure.
3. Thick canes in trenches made at different distances. Some white medium provincial canes which proved better than the local varieties have been sown on a large scale and their seed as much as available has been distributed to cultivators also. Thick chewing canes have now gone out from the Farm to the rich lands near the Bareilly town. Of the several varieties the Mauritius canes nos. 16 and 33 black, the red striped and the Saharanpur black have specially suited the Bareilly town.

II. Trial of varieties of wheat, rice, cotton, groundnuts, gram and maize—

Pusa wheat no. 12, Pusa grams 5b and 6A white and Muzaffarnagar wheat have been found to be better than the local wheat and gram and their seed is stored and distributed from this farm.

The Sugar Factory was worked by Mr. Hulme.

The Muttra and Agra farms have proved the value of the following things and seeds are now distributed on a large scale.—

1. Pusa wheat no. 12.
2. White flowered Aligarh and Bahrampur cotton.
3. Saretha canes.
4. Groundnuts.

The Cawnpore American and Buri cottons have also been tried and they gave a promising outturn.

The Bulandshahr Farm grows for seed and supplies Pusa wheat no. 12, Muzaffarnagar wheat, cotton seed, sugarcane, groundnuts, oil engines and pumps. It is the chief centre for supervision and repairs of the pumping installation supplied in the Bulandshahr district.

Miscellaneous work.

1. The steam plough set has gone from Muttra to the Government Tarai and Bhabar Estates at Kichha in Naini Tal, where there is a vast area which can be brought under cultivation after breaking it with the steam plough. To begin with a block of a few hundred acres has been selected at village Turkagori about five miles from Kichha along the Bareilly-Naini Tal road for ploughing with it by the Superintendent of the said estates and the tractor has gone there. The area broken last year with this tractor at village Mughera in the Muttra district has been sown this year with the rains with fodder crops by the owners of the land.

2. The work of testing wells for pumping installations was continued and several installations were supplied. Unfortunately the engines from England could not be had on account of the war which became a check in the progress.

GANGA PRASAD,
Officiating Deputy Director.

APPENDIX A.

Statement showing the seed supply during 1915-16 *in the Western Circle.*

Name of seed.	Aligarh.	Bareilly.	Agra.	Muttra.	Bulandshahr.	Saharanpur.	Shahjahanpur.	Total.	Remarks.
Wheat Pusa no 12 ..	737	81	215	110	440	237	125	1,945	Mds.
„ „ 101 ..	..	..	12	..	..	..	..	12	„
„ „ 106 ..	..	..	..	12	..	..	..	12	„
„ Aligarh ..	..	..	..	71	..	..	..	71	„
„ Muzaffarnagar ..	52	26	72	99*	31	25	..	305	„ *76 Mds. direct from Muzaffarnagar to Tarai and Bhabar Government Estates, Naini Tal.
Cotton W. F. ..	371	..	258	642	45	..	..	1,316	„
„ Bahrampur ..	..	..	4	1	65	..	..	70	„
„ Tall plant ..	..	..	3	36	..	..	..	39	„
„ Buri ..	133	..	10	2	25	..	..	170	„
Groundnuts ..	..	13	16	5	1	..	..	35	„
Suretha Ekh ..	59,000	17,000	..	45,720	22,276	..	..	143,996	Number of canes.
J. 33	..	83	..	..	284	..	..	367	Mds.
Other varieties of Ekh ..	..	46,000	..	18,550	..	..	..	64,550	Number of canes.
Paundas	..	223	..	..	210	120	..	553	Mds.
Gram	..	93	..	..	7	..	..	100	„
Rice	..	8	..	..	..	..	..	8	„
Oats	21	..	3	6	23	..	..	53	„

N. B.—One md. = 82 lbs

APPENDIX II.

Report on the Administration of the Central Circle of the Department of Agriculture, United Provinces, for 1915-16, *by* MR. B. C. BURT, B.SC., *Deputy Director of Agriculture.*

Staff.—I was in charge of the circle throughout the year with the exception of one month's privilege leave, during which period Pandit Nand Kishore Sharma, Farm Superintendent, held charge of the current duties of my office. Two diplomates from the Agricultural College were appointed to the Subordinate Agricultural Service on probation towards the close of the year and posted to this circle. The staff is still totally inadequate for the growing work of the circle.

Agricultural stations.—These remain as last year. A demonstration farm has been opened in the Hardoi district which is financed by the district board supervision being provided by the department; an initial grant was made by Government for buildings and equipment. This supplies a much needed centre for our work in that district and in the Oudh portion of the circle.

District work.

Cotton.—In the canal-irrigated portions of Cawnpore, Etawah, Farrukhabad, and Mainpuri districts the introduction of American cotton was continued and a start was made on a small scale in Fatehpur. The season was an unfavourable one in every way. The low prices of the previous season had caused a general lack of interest in cotton cultivation and this was enhanced by the attractions offered by indigo, sugarcane, and food crops. In those villages which had sown American cotton before, a larger proportion of American was sown this year, the value of the extra price being appreciated. The area actually sown was 1,200 acres and this would have been considerably larger had sufficient canal water been available—several villages having to return unsown seed. Some of the sowings took place later than was desirable and failed, but the condition of the crop was on the whole good until the end of August. The phenomenal rain during the last week of August and first two days in September—as much as the normal rainfall for the whole of the monsoon period—caused widespread damage throughout the greater part of the area in which American cotton was sown. Many fields of both *desi* and American cotton were entirely destroyed and could only be ploughed up for *rabi*. Other fields which were well-drained recovered partially but yielded something like one-third of a normal crop: the extent of the damage can be gauged from the fact that on the Experimental Farm and Seed Farm, on well-drained land where every possible means of preventing actual flooding was used, the damage varied from 40 to 60 per cent. As a result the quantity of *kapas* offered to the department was small and what there was contained a very high percentage of damaged cotton which it was necessary to remove before ginning. The amount of cotton finally available for disposal was 117 bales,* which was taken over by the Muir Mills Company at favourable prices, enabling the substantial premium of Rs. 2 per cotton maund† of *kapas* to be paid to growers.

The better prices obtained last year led to a keener demand for seed this year and a large area was expected. The actual area sown will not be known until the end of August but it will clearly be much short of expectations. The unavoidable shortage of canal water made sowings exceedingly difficult and although some American cotton was sown on the early rains much seed has remained unsown. The introduction of American cotton has received three very severe setbacks in the shape of the slump caused by the war, a disastrous flood and a shortage of canal water such as not has occurred for some twenty years. Consequently the amount available for supply to the trade has not increased at the rate that would have been otherwise expected. Given one or two good seasons and an adequate supply of canal water there is every reason to believe that American would largely replace *desi* cotton in certain areas; the future of the crop is however entirely dependent on an adequate supply of canal water between the beginning of May and the middle of June.

Aligarh while flowered cotton.—The distribution of this cotton was continued in Hardoi and Unao districts in 1915 and on a smaller scale for unirrigated sowings in Cawnpore. Seed for about 327 acres was issued by the department and in addition the Sandila Central Co-operative Bank issued seed to its members. The demand for seed was much smaller than usual owing to the general fall in the cotton area in these districts.

For the coming season the demand for seed was keen and the whole of the available stock was rapidly sold out; 41 maunds being issued from Cawnpore and 100 maunds from the Gauria godown (seed ginned under supervision from *kapas* bought in from selected cultivators). There is also a large area under this cotton from seed kept by cultivators themselves.

K. 22.—This hybrid cotton received from the Economic Botanist, United Provinces, which has a much better lint than *desi*, was distributed in 1915 for trial in several places. The trials in Unao and Hardoi were upset by floods, which practically destroyed the cotton crop, but it yielded at least as well as *desi* and the *kapas* was worth a good deal more. There has been a demand for seed this year and 59 maunds ‡ have been distributed for further trial and demonstration in Unao and Hardoi districts and in those portions of Etawah and Mainpuri districts which are either unirrigated or where the canal supply is too doubtful to permit of the cultivation of American cotton.

K. 7.—The distribution of this selected cotton received from the Economic Botanist was continued in Bundelkhand in 1915. As there was no water available for cotton-sowing from the

*Of 400 lbs. † 102 lbs. ‡ 1 maund = 82·31 lbs.

Betwa Canal and as the monsoon was somewhat late in establishing itself, the demand for cotton seed was small particularly as the low prices of the previous year had discouraged cotton-growing materially. Considerable progress was however made on the Dhasan Canal Division in the Hamirpur district. For 1916 sowings 87½ maunds have been distributed in the Jalaun (Jalaun tahsil), Hamirpur (Rath tahsil), and Banda districts. The lint of this cotton is appreciably better than that of ordinary *desi*.

II. Wheat.—In the Oudh and *doab* portions of the circle the systematic introduction of Pusa 12 wheat was continued and the demand for seed was far in excess of the supply. The actual quantity of seed issued was 2,037 maunds. In the Hardoi district 541 maunds were issued through the Hardoi and Sandila Central Co-operative Banks and 61 maunds in Unao through the Unao Town Bank and 49 maunds through small co-operative societies. In the Etawah district 412½ maunds was issued through 411 zamindars, while in the Sitapur district the Court of Wards Estates issued 401 maunds to its tenants.

Smaller quantities were supplied through other co-operative banks and to individual growers chiefly for demonstration purposes. Of the seed issued 1,277 maunds was produced on our own farms and 740 maunds was received from Behar through the Imperial Economic Botanist.

Arrangements were made by the Sandila and Hardoi Co-operative Banks to buy in the produce of the seed supplied and similar arrangements were made by the Special Manager of the Sitapur Court of Wards Estates. In the Etawah district various zamindars took seed on the understanding that a certain portion of the produce should be sold back to the department for seed-supply. In this way a total of 6,133 maunds of Pusa 12 wheat was bought in after harvest of which the Sitapur Court of Wards contributed 1,405 maunds, the Hardoi Central bank 1,175 maunds, the Sandila bank 1,222 maunds, various co-operative banks and a few zamindars in the Unao district 482 maunds, and the Etawah district 1,078 maunds. Small quantities were also received from neighbouring cultivators and from zamindars in the Mainpuri district. After cleaning 5,376 maunds was handed over to Messrs Ralli Bros. for shipment to England in fulfilment of the arrangements made for the shipping experiment in progress in conjunction with the Imperial Economic Botanist. The detailed results of this experiment will be published jointly with Mr. Howard in due course. The wheat shipped was replaced by a pure stock from Behar and from the produce of our own farms the quantity available for distribution in the coming season being 7,443 maunds. The replacement of cultivators' wheat by pure seed which it has been possible to effect will be of material help in establishing considerable areas of this wheat pure. Until a new wheat is sown in large compact areas to the exclusion of other wheat, the introduction of impurities by mixing on the threshing floor is almost unavoidable and is a factor which must be taken into account in all seed distribution schemes which involve the purchase of cultivators' produce. Samples of all the wheats shipped have been kept and will be sown this year at the Experimental Farm to determine the degree of mixing which has taken place. It may be noted however that in most of the wheat purchased it was impossible to detect any mixing and as commercial samples they would be passed as pure. Pusa 12 wheat is now firmly established in portions of the Sitapur, Hardoi, Unao, and Etawah districts and is spreading naturally.

In the Kheri Court of Wards Pusa 106 has continued to do well. Comparative trials with Pusa 12 and Pusa 106 wheat have however given results in favour of Pusa 12 and the Special Manager has arranged to distribute a larger quantity of Pusa 12 this year with a view to discontinuing Pusa 106 if Pusa 12 continues to do well. The advantage of reducing the number of types of wheat under introduction to a minimum is obvious.

Pusa 4.—This wheat was again distributed in Bundelkhand for sowing in irrigated tracts. In Jalaun district it was distributed chiefly on the Kathaund Branch of the Betwa Canal, the largest areas being around Madhogarh and Konch. In the former tract Pusa 12 also does well in normal years and it is likely to establish itself but at present it has been considered desirable to allow cultivators to choose which they will grow. Pusa 12 is slightly too late for the Konch area and is not issued there.

In the Banda district 536 maunds of Pusa 4 were issued from the Atarra Farm, part of which was farm produce and part received from the Imperial Economic Botanist. It again did well and is rapidly becoming popular. In the Hamirpur district a small quantity of Pusa 4 was also distributed for demonstration purposes around Rath and here also it did well. The Executive Engineer, Dhasan Canal, also kindly arranged for the distribution of a small quantity of this wheat in the Rath tahsil of Hamirpur on a selected area: excellent results are reported and a large area will be sown next year. A stock of 2,986 maunds has been arranged for and indents for a considerable proportion of this have already been received.

For the non-irrigated black soils Soharia wheat was again issued on a small scale.

III. Sugarcane.—Java 33 cane is being systematically introduced by the Sitapur and Kheri Court of Wards estates and 1,400 maunds of cane for planting was supplied this year from the Agricultural Chemist's farm at Shahjahanpur. Demonstrations and trials on a small scale are being carried out in other districts. The Ashy Mauritius variety has been dropped for general distribution as it is somewhat delicate though a magnificent yielder under suitable conditions.

In Cawnpore district the Reora variety of *ukh* continues to be popular and in one portion of the district is grown on a very considerable scale. Some tentative issues of cane for planting have been made from the Atarra Farm, but the general introduction of cane in this

tract will not be undertaken until it is clear that the new Gangao dam on the Ken Canal can supply sufficient water between February and July.

IV. Rice.—Two vareties of rice grown at the Atarra Farm have proved better than local varieties and there was a keen demand for seed, 87 maunds being issued to 167 cultivators. Distribution for the current crop is still proceeding but the quantities issued are larger than last year.

Transplanting of rice was again demonstrated near Atarra arrangements being made to supply seedlings from the farm as many men had not irrigation facilities for rice nurseries. The results were successful but it is doubtful whether the practice will become general owing to the scarcity of labour. In the present *kharif* it is estimated that an area of about 500 acres is being transplanted, the favourable, early rains materially encouraging transplantation.

V. Juar.—Three selected varieties continue to do well and to increase in popularity; 214 maunds of seed were issued from the farms during the year.

VI. Ground-nuts.—This crop is steadily expanding though it is difficult to get accurate figures. It is now only necessary to maintain a supply of seed of the variety most generally liked for supply to new growers and to those who wish to renew their stock.

VII. Arhar.—The early ripening variety of arhar continues to grow in popularity chiefly for sowing with cotton; 99 maunds of seed was issued.

VIII. Indigo.—Inspection of the growing Sumatrana indigo crop in the vicinity of Cawnpore with the Economic Botanist to Government having shown that, as the result of *bazar* purchased seed, the crop was in many cases a mixture of the old Cawnpore *desi* with Sukkur indigo and other types, arrangements were made for a supply of seed from fields which were apparently pure. A stock of 85 maunds was obtained in this way for supply to growers in the province and some Behar factories were also put in touch with growers who could supply them with good seed.

By arrangement with certain Behar factories two zamindars in the Cawnpore district are growing Java-Natal indigo for seed on a considerable scale.

General.—Some demonstrations of the value of hot weather ploughing were carried out on zamindars' land in the Banda district and good results obtained. Green manuring has always done well at Atarra farm and demonstrations were arranged amongst local cultivators, who green manured 12 acres for wheat. Good results were obtained and a larger area is being similarly treated this year.

Mahua cake being now available at cheap rates, arrangements were made for the supply to cultivators, co-operative banks, and others of 3,503 maunds for manuring sugarcane, tobacco, and potatoes. The results obtained so far are satisfactory. At present prices mahua is considerably cheaper than castor cake, which is at present the most common oil-cake manure and it can consequently be much more generally used with profit. A grant was given by Government for the purchase of the manure; in most cases freight and cartage were paid by the recipients.

Potato storage.—The potato moth continues to do considerable damage, chiefly in the Farrukhabad district. Storage demonstrations were continued and this year 26 individuals stored 7,340 maunds under our supervision, in addition to several thousand maunds stored by various growers in quantities of less than 20 maunds. Experiments are also in progress both at Cawnpore and Farrukhabad to determine the most suitable method for avoiding the loss in stored potatoes frequently caused by a fungus disease. The demonstration store at Farrukhabad made a profit of 24 per cent.

Agricultural shows.—District exhibitions with agricultural sections were held at Etawah, Hardoi, Sitapur (Khairabad), Unao, and Mainpuri. Of these the Etawah exhibition was probably the best from the agricultural point of view, a feature being the number of crop exhibits of good quality—a large proportion of which were from seed of special varieties supplied by the department. As usual one of the main features of the Hardoi exhibition was its close relationship with the co-operative societies of the district and, as in past years, a very successful joint agricultural and co-operative conference was held. The Khairabad fair attracts large numbers of visitors and the agricultural show there was a distinct success. The Mainpuri show is managed by the local agricultural association; there was a considerable improvement in the number and quality of exhibits and a large number were again from seed supplied by the department: though smaller than most others this show serves a useful purpose. The Unao district exhibition held at Takia has never been a real success and the district authorities have now wisely decided to hold it at district headquarters in future.

Relations with co-operative societies have been further developed during the year. Reference has already been made to the work carried out by the Hardoi District Bank, Unao Town Bank, Sandila and Jasrana Central Banks in connection with the introduction of Pusa 12 wheat and the subsequent repurchase of produce from members. In addition distribution of considerable quantities of other seeds was effected and advantage was taken of the organisation to spread agricultural information generally. A number of smaller societies also took seed in appreciable quantities, notably the Ramnagar Central Bank, Allahabad, the Mainpuri Central Bank, the District Co-operative Bank, Ld., Fatehpur, the Takia Nigohi Co-operative Bank, district Unao, the Rampur Khanjri Co-operative Central Banking Union, Unao, the Safipur Co-operative Central Banking Union, Ld., Unao, the Rampur Co-operative Bank, Unao, and the Unchgaon Co-operative society, Ajgain, Unao.

Mahūa cake for manurial purposes was also issued through a number of these societies. A large proportion of the seed issued from the Atarra farm was issued through the co-operative societies of the Banda district and in the Jalaun district a considerable amount of wheat seed was supplied through the societies forming the Orai Central Bank. While extensive seed schemes, such as are being worked up with the Sandila and other banks, require the active support of a strong central or district bank, there are a number of cases where the assistance of smaller societies has been of considerable service without involving the societies in any pecuniary responsibilities. But for the ever-increasing difficulty of providing an adequate supply of pure seed greater progress would have been made.

Near Hardoi a tube well has now been completed capable of irrigating some 5 to 6 acres per working day. The tenants of the villages commanded are largely members of three co-operative societies affiliated to the Hardoi District Bank and it is proposed to ultimately hand over the working of the installation to that institution. For the first year the management will be undertaken by the department with the object of obtaining accurate figures of the working expenses and details of management. If, as is expected, it can be shown that these installations can be worked so as to give a reasonable return on capital there seems no reason why a number should not be installed in this district where large areas exist in which masonry wells are almost or quite impracticable.

Demonstration and seed farms.

The expenditure on the Kalianpur seed farm for the year was Rs. 9,000, of which Rs. 3,680 was capital expenditure necessitated by expansions, the working expenses being Rs. 5,320 and receipts Rs. 5,460. Since the receipts credited in any particular financial year refer chiefly to the crops grown in the preceding year a better estimate of the financial results of the year's working can be obtained by comparing the value of the produce with the expenditure. Exclusive of produce used on the farm the produce of the year is valued at 8,108 rupees if wheat is valued at harvest rates or Rs. 9,233 if probable prices at selling time are taken. The farm has therefore yielded a nett profit even when the cost of the permanent establishment (Rs. 2,040 much of which is required for experimental work) is included.

The Etawah farm cost during the year Rs. 2,391 for working expenses while the produce, apart from that consumed on the farm, was valued at Rs. 2,909 at harvest time, or Rs. 3,220 if probable selling rates for seed are taken. Including expenditure of Rs. 375 on permanent establishment, this farm has also more than paid its way. These results obtained from two farms, both of which had considerable areas under cotton in a year when owing to phenomenal bad weather in September the cotton crop yielded less than half the normal, show that the production of pure seed on large areas can be carried out at no expense to Government once the farm is established (and even at a reasonable profit) without assuming any appreciable premium for the higher value of the seed. But, as pointed out in last year's administration report, various circumstances prevent these farms being worked on purely commercial lines and any attempt to do so would be to sacrifice the main object of the farm.

Private farms.

It has not been the practice in the past to refer in detail to demonstrations carried out on zamindar's *sir* land as these form part of the regular work of the circle and it is hardly correct to call these farms. Several zamindars are now growing seed for the department on a considerable scale and are using their *sir* land as real demonstration farms. Of these Tewari Ram Ghulam of Kuderkot, Thakur Balwant Singh of Banthra, Tewari Kalka Prasad of Heonra, Chaudhri Lachhman Singh of Kua, Chaudhri Hanu Prasad, Pandit Brahma Din and Thakur Puttu Singh of the Etawah district, Thakur Digbijai Singh of Tindauli, Thakur Saledi Singh, Thakur Gulab Singh, Thakur Hukm Singh of the Mainpuri district, Babu Narayan Prasad and Pandit Bindeshwar Misra of Mandhana in the Cawnpore district and Raja Ragho Prasad Narayan Singh of Baraon, Allahabad, deserve mention as well as numerous other zamindars whose co-operation with the department has been of distinct value. There are very few large estates in the circle where large farms, such as are possible in parts of Oudh, are feasible.

Court of Wards Estates.

The Special Managers of the Sitapur and Kheri Court of Wards estates continue to give valuable assistance in the introduction of improved crops; but for their assistance it would have been impossible to carry out any appreciable amount of work in these districts owing to the shortage of staff of all grades. The excellent work which the Sitapur Court of Wards estates have done in the systematic introduction of Pusa 12 wheat and in the demonstration of the value of Java 33 sugarcane has already been referred to. The Sitapur Court of Wards estates now own their own seed store which materially lightens the labour of seed-supply.

In the Kheri Court of Wards great assistance has also been received in respect to both wheat and sugarcane.

Experimental Work.

At the Cawnpore Farm experiments on wheat, cotton, sugarcane, juar, gram, and arhar have been continued. The selection work with American cotton has now yielded definite results and several distinct types have been isolated which are now being compared on a field scale. Several of these showed great promise last year but the floods in September made any accurate comparison of outturn impossible and made the determination of the commercial

values of the cotton uncertain. Some types have been isolated which have as short a vegetative period as ordinary *desi* cotton. If these stand further trial as regards their other characters they will possibly be of great use in extending the possible sowing period but there is some reason to believe that the root system is also of great importance in determining the time at which American cottons must be sown and this point is under study.

Some interesting results have been obtained in the course of manurial experiments in the manuring of *do-fasli* crops showing that the limiting factor is the time available for nitrification after the removal of the *kharif* crop. Incidentally it was found that it was possible to grow a good crop of any early ripening wheat (such as Pusa 4) after the removal of a heavy crop of fodder juar. Experiments with wheat have been chiefly limited to cultural experiments as Pusa 12 has been shown to be thoroughly satisfactory for this part of the circle. Demonstrations in the use of lever harrows to conserve moisture after the first irrigation and thus economise the use of irrigation water are now being taken up. Experiments on surface drainage of some low-lying parts of the Cawnpore Farm which were previously unfit for wheat in many years are being continued; last year in spite of unusually heavy rains these fields yielded a good crop of wheat.

At the Atarra Farm Pusa 4 wheat again did well and was grown on a large scale for seed-supply. A new wheat received from the Economic Botanist, United Provinces, and known as Cawnpore 13 also did very well and may prove better than Pusa 4 for this tract. A fine crop of sugarcane was obtained this year with several varieties Java 33 being the best. It is clear that given an assured water-supply, this crop would do very well in the neighbourhood of Atarra.

At the Orai Farm Pusa 4 was again the most generally satisfactory of the wheats and at Madhogarh both Pusa 4 and 12 did very well. At Orai Soharia wheat which is recommended for black soils with little or no irrigation was again satisfactory. Experiments with juar varieties confirmed the superiority of those varieties which are being issued; several others are being tested further. Tests of several gram varieties are being continued. It has again been shown that the local practice of sowing mixed wheat and gram on irrigable black soils is less profitable than sowing wheat and gram in rotation. The practice of mixed sowings however will probably take a long time to die out and meantime it is of interest to note that Pusa 4 wheat did quite well when sown as a mixed crop with gram. Groundnuts did well at both Orai and Madhogarh and the crop would probably extend more but for the risk of damage by wild pig.

Excellent results were obtained by green manuring on *Parwa* soil at Madhogarh.

Very fair yields were obtained with potatoes both at Atarra and Madhogarh and it is of interest to note that the cultivation of this crop is extending in the Parwa tracts both of Banda and Jalaun.

Seed-Supply.*

The central seed store at Cawnpore issued 2,404 maunds of seed during the year excluding 473 maunds of sugarcane from the Cawnpore Farm. The principal items were wheat 1,201 maunds, cotton 735½ maunds, juar 77½ maunds, barley 152½ maunds, indigo 66½, early arhar 61 maunds, and gram 27 maunds. In addition 600 maunds of Pusa 12 wheat from the Kalianpur Farm was supplied to the Hardoi and Sandila Co-operative Banks.

The Atarra Farm supplied 1,405 maunds of seed including wheat 642 maunds, sugarcane 195½ maunds, sann hemp 115 maunds, rice 86½ maunds, juar 88 maunds, cotton 71½ maunds, peas 28½ maunds, and groundnuts 22 maunds.

The Orai Farm distributed 827½ maunds of seed, of which the principal items were wheat 741½ maunds, cotton 18 maunds, and juar 43 maunds.

From the Madhogarh sub-station 361 maunds of seed were distributed, of which the principal items were Pusa wheat 236 maunds, and sugarcane 100 maunds.

From the Etawah Farm 1,063 maunds of seed were issued including 438 maunds of wheat, 523½ maunds sugarcane, and 73 maunds of cotton seed.

From the Mainpuri Farm the principal item was Pusa 12 wheat but smaller quantities of other seeds were also issued for demonstration purposes.

Implements.

From Cawnpore 382 implements of various kinds were issued, of which the more important were 288 ploughs, 17 chain pumps, 14 harrows and cultivators, 16 chaffcutters and kibblers, and 11 sugarcane mills. From the Etawah Farm 50 implements were sold (in addition to 44 spare parts for ploughs) mostly ploughs. From the Atarra Farm 21 implements were issued. The Orai Farm issued 5 implements only but gave a number on hire. The Madhogarh sub-centre issued 35 implements, mostly ploughs, of which a number were originally given on hire but were subsequently purchased on instalments. Orders for 165 implements and 559 spare parts were passed on to a local agency and the same agency supplied direct 76 implements and 197 parts.

Of the implements supplied small iron ploughs form the bulk and the demand for spare shares and parts show that they are in use. On the whole the demand for implements during the year was below the average of recent years.

* These figures cover the administrative year and therefore refer to portions of two *kharif* seasons.

It is hoped that during the coming year arrangements will be made with some of the larger co-operative societies for the sale of implements recommended by the department, thus relieving the department of the necessity of acting as a middleman for implements the suitability of which has been established.

Correspondence increased slightly during the year, the number of letters received being 4,302 and issues 4,060. Agricultural enquiries numbered 430 apart from the ever-increasing number dealt with through the touring staff.

Receipts for the circle during the year amounted to Rs. 16,260-10-0. As in the previous year, this is much below the actual value of the produce of the farms as much larger stocks of seed are held than previously.

Publications.

Articles on Teff grass, the supply of agricultural implements by Co-operative Societies, and the suitability of Pusa 12 wheat for local consumption, were contributed to the Agricultural Journal of India. A paper on the re-alignment of agricultural holdings was read at the Indian Science Congress, Lucknow. Revised editions of most of the vernacular pamphlets were prepared and a list of those now current is appended.

CAWNPORE :

Dated the 25th August, 1916.

B. C. BURT,
Deputy Director of Agriculture,
Central Circle.

List of pamphlets and leaflets issued from Cawnpore.

Pamphlets.

1. Cultivation of American Cotton.
2. Hot Weather Cultivation.
3. Ground-nut Cultivation.
4. The Potato Moth and Methods of preventing Damage to Stored Potatoes.
5. Notes on improved Crops recommended for the Central Circle.
6. The Sugarcane Hopper (Phangi).
7. Maize Cultivation.
8. Cultivation of Lucerne.
9. Smut on Juar and its Prevention.
10. Gur-making.
11. The Reduction of the Cost of *Rabi* Harvesting by the use of Implements.
12. Sugar and Maize Pests.
13. Cultivation of Pusa Wheat.
14. Ploughs and their Use.

Leaflets.

1. San.
2. Silage.
3. Potato Storage at Farrukhabad.
4. Aligarh White Flowered Cotton.
5. Use of Poudrette in Bundelkhand.
6. Methods of Improving the Yield of Wheat where the Manure-supply is deficient.

APPENDIX III.

Report on the Administration of the Eastern Circle of the Department of Agriculture, United Provinces, for 1915-16 *by* MR. L. C. SHARMA, M.R.A.C., P.A.S.I., *Bar.-at-Law, Assistant Director of Agriculture.*

Staff.—I remained in charge of the Eastern Circle throughout the year.

The work of the Eastern Circle done during the year under report may be classified as follows :—

I.—Experimental investigations.
II.—Demonstration work.
III.—Private farms and their organisation.
IV.—Seed dépôts and their organisation.
V.—Miscellaneous work.

I.—Experimental Investigations.

These were carried out chiefly at the Partabgarh and the Benares Agricultural stations, and the details of this work are given in the respective reports of the said stations for the year 1915-16.

It will suffice to mention here a few points in brief regarding the results of a few more important investigations only :—

(*a*) *Varietal experiments.*—It has now been definitely ascertained from the results of the last four years that Pusa 12 wheat, improved barley, large Japanese ground-nuts, Jaunpur maize, thorny bajra, are best suited for the locality.

(*b*) *Manurial experiments.*—Neem cake applied to paddy crop at the rate of 600 lbs. per acre will increase the outturn by nearly 50 % per acre.

(*c*) *Seedling and spacing experiments.*—One seedling at 8″ apart gives the highest outturns specially in the case of Joginia variety of rice.

(*d*) *Seed rate experiment.*—40 to 55 seers per acre for wheat gives the best results.

(*e*) *Green manuring with sann hemp.*—Pusa 12 wheat on an acre of land green manured and drained after the Pusa system, gave 2,193 lbs. of superior quality of grain and 3,570 lbs of bhusa.

(*f*) *Dofasli rotation* (*i. e. two crops in rotation in the same year*).—The results of this experiment show that Jaunpur maize and white peas in rotation and that maize and barley in succession give the highest profit per acre.

(*g*) *Preservation of fodder in silo.*—A *pakka* silo constructed in the compound of the Cooperative Dairy, Lucknow, a mention of which was made in last year's report, was merely experimental and could not supply silage to the dairy cattle even for a few days, so a large silo was constructed during the year under report; but owing to want of funds could not be filled up with fodder and will therefore form the subject of next year's report.

(*h*) *Eradication of roshna and rari weeds in Jaunpur and Ballia districts respectively.*—It has now been definitely ascertained that the roots of these weeds can be destroyed for three years at most by merely ploughing up the fields a few times about 9″ deep with a heavy iron plough during the rainy seasons. Wheat and barley crops can be taken most successfully next season in the area so prepared. The operations of deep ploughings with Watts or Rajas ploughs are however somewhat expensive and troublesome. A Motor plough would probably do better and might reclaim thousands of acres which are now lying useless under these weeds.

(*i*) *Reclamation of usar land.*—The experiments conducted during the last three years show that a crop of early paddy can be taken in usar land by making bunds and holding water in the field provided ample water-supply is procurable.

Deep ploughings of the usar land and washing off the salts during the rainy seasons for two years by means of drains and a gentle slope to the fields protected with Sarpat or any other thick grass at the lower end has also improved the fields to a considerable extent for growing *kharif* crops and also *rabi* where sufficient irrigation was available.

II.—Demonstration work.

Some of the definite results obtained at the Government Agricultural stations of this circle, made it desirable that such results should be brought to the notice of the interested zamindars and cultivators, so as to familiarize them with the full advantages thereof. This object was served by (*a*) District Demonstration farms and (*b*) District demonstrations given in cultivators' fields on large scales after a co-operative system.

There are now ten demonstration farms in the circle and 1,822 demonstrations of improved means of cultivation were given in cultivators' fields.

An immediate result of the demonstration farms and the demonstrations given, has been that the people who were under the impression that higher outturns from our approved seeds were due to heavy expenditure on cultivation, have now begun to realize that an expenditure not beyond the cultivator's means is sufficient to grow after improved methods of cultivation crops yielding almost double the outturns ordinarily obtained. Hence arose a large demand for approved seeds and improved machines and implements, specially for Pusa 12 wheat and ploughs. The

Government was pleased to advance Rs. 30,000 during the year under report to meet the requirements of taluqdars and zamindars, for the former.

III —Private farms and their organisation.

The interest of some of the taluqdars and well-to-do zamindars is growing towards agriculture and their private farms are becoming a special feature of the work of this circle.

There are now 41 private farms in this circle and a good deal has been done towards their organistion during the year under report. Those that are less than 20 acres in area have not been included in the number mentioned above, not those that have recently been started by some of the vakils and taluqdars of Lucknow district.

A good many of the owners have supplied me with copies of detailed reports of their respective farms, which show large profits but want of space does not allow me to describe them in this report, so I content myself only by showing their results in the briefest form possible as follows :—

(1) *Kusaha farm.*—It belongs to Raja of Amethi and is 150 acres in area, just situated close to his palace. The total area was divided into 3 blocks, according to the physical conditions of the soil, one of 30 acres for early paddy, 2nd of 70 acres for late paddy, and the rest for *rabi* and sugarcane. Under the instructions of the Assistant Director Jugania, Bansmati, and Pusa 12 were tried in these blocks respectively; in spite of the adverse season the crops did well. The farm was visited by Mr. Howard, Economic Botanist to the Government of India. He noted that "The value of an example such as the Amethi Raj farm is very great at the present time. It is most useful in showing how Oudh can be developed; it proves that agriculture on modern lines pays well under Indian conditions and it supplies an answer to those critics of the Agricultural department who say that nothing is being done for the people and that the work on the Government farm leads to little of practical importance. Mr. Sharma, in initiating these private seed farms under the Taluqdars of Oudh, has started a new movement in Indian Agriculture, which promises to be of the greatest value not only to Oudh but also to the rest of India."

The following statement gives the profits made on the farm during the year under report :—

	Receipts.		Total.	Total recurring expenditure.	Profit per acre
	Grain.	Straw.			
Paddy.. ..	6,470	1,850	8,320	..	..
*Pusa 12 wheat ..	2,555	1,277	3,832	..	..
Other crops ..	..	..	340	..	..
	..	..	12,492	7,065	36

* Suffered from drought. Pumping plant now installed.

(2) *Shivedarshan farm.*—This farm was started during the year under report through the sole exertions of Kunwar Sahib of Amethi. It is 50 acres in area and worked under his direct supervision. The levelling and laying out of the whole farm was not quite complete during the year under report. Pusa 12 wheat and improved Rewari barley were tried on 8 and 4 acres respectively. The average outturns of these crops were 26 maunds and 34 maunds per acre respectively. Mr. Howard, the Imperial Economic Botanist, remarks that the crop of Pusa wheat was the best he had so far seen and that the expenses of cultivation would probably be less than the sale proceeds by the "*bhusa.*"

(3) *Dhamrauan farm.*—It is 80 acres in area and belongs to Raja of Amethi. The net profit made by the Raja on this farm during the year under report was Rs. 5,400, viz. Rs. 67-8-0 per acre. There was only one well on this farm and a pumping plant has now been put up in it to facilitate irrigation. This will increase the profits of this farm from next year.

(4) *Kurri Sudauli farm.*—This belongs to the Honourable Sir Raja Rampal Singh, K.C.I.E., of Kurri Sudauli and is 60·6 acres in area. The crops are reported to have suffered much from the excessive rains. The following statement received from the Manager of the farm shows that in spite of adverse circumstances the farm made a net profit of Rs. 299-8-0 after paying off Rs. 667-10-0 as rent of the farm and taking into account all the recurring and non-recurring expenditure of the farm :—

Receipts out of the farm produce.			Expenditure of the farm.				Net profit.
Grain.	Straw.	Total.	Expenditure including recurring and non-recurring.	Rent.	Pay of the establishment.	Total.	
Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
2,259 1 3	318 8 0	2,577 9 3	1,210 2 6	667 10 0	400 4 9	2,278 1 3	299 8 0

(5) *Chandapur farm.*—It belongs to the Honourable Raja Chanda Chur Singh of Chandapur and is situated about 17 miles towards the north of Rae Bareli railway station. The area of the farm is 75·8 acres. For facility of irrigation a pumping plant has been installed by the Raja with the result that water-supply has been considerably increased. Pusa 12 wheat is replacing the local variety of wheat among the cultivators of his estate and the improved Agricultural Implements are getting popular in the neighbourhood of the farm.

His Honour the Lieutenant-Governor of the United Provinces visited this farm as well as the Turner Demonstration Farm, Rae Bareli. His Honour congratulated the Raja for the admirable work he had undertaken in advancing the cause of agriculture.

The following statement shows the financial position of the farm :—

Receipts of the farm.				Expenditure of the farm.				Net profit.
Receipts of *kharif* produce.	Receipts of *rabi* produce.	Miscellaneous receipts.	Total.	Labour together with cost of seed and manure.	Pay of staff.	Miscellaneous.	Total.	
Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.
1,606 9 0	1,966 15 0	104 6 0	3,677 14 0	796 9 9	758 12 6	95 6 0	1,650 12 3	2,027 1

(6) *Fort Partabgarh farm.*—Its area is 30 acres and belongs to Raja Partap Bahadur Singh, C.I.E., of Fort Partabgarh. Pusa 12 wheat and other profitable crops were grown at this farm after the improved methods of cultivation under directions of Assistant Director of Agriculture.

The following statement gives the financial position of the farm :—

Area.	Total receipts.	Total expenditure.	Net profit.	Remarks.
Acres.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
30	2,370 7 2	1,225 11 9	1,144 11 5	

(7) The Sesaindi Court of Wards (Lucknow) started two farms in Mohanlalganj tahsil in co-operation with the tenants in two of its villages Dhewa and Mau on areas of 22 and 23 acres respectively. The Court of Wards earned 53 maunds 28 seers 12 chhataks of Pusa 12 wheat and 14 maunds 11 seers 10 chhataks of other improved *rabi* grains valuing in all Rs. 298-4-3 from the Dhewa farm and 86 maunds 2 seers 8 chhataks of Pusa 12 and 16 maunds 27 seers 8 chhataks of other *rabi* seeds valuing Rs. 439-11-9 from the Mau farm.

In other words the Court of Wards' profits from the said areas which would ordinarily have been Rs. 160-6-0 and Rs. 160-12-0 only in the form of rent had exceeded by Rs. 137-14-3 and Rs. 278-15-9 respectively after paying off the rent, and giving away all the bhusa to the tenants.

(8) *Malikpur farm.*—It belongs to S. Muhammad Shafi, zamindar of Baskhari in the tahsil of Tanda (Fyzabad). The farm is situated on *pakka* road about 15 miles from Akbarpur on the Akbarpur-Ramnagar road.

Pusa 12 wheat and improved Rewari barley chiefly were tried on this farm and a large portion of the produce of Pusa 12 was purchased by our seed dépôts.

Total receipts were Rs. 1,611; expenditure Rs. 317.

(9) *Model farm.*—It is about 400 acres in area and situated on the Rae Bareli road 7 miles from Amethi railway station. It is worked by the circle officer in co-operation with the Raja of Amethi. The wheat crop grown on this farm on 60 acres was threshed by the threshing plant. One of the existing wells of this farm was bored with success and a pumping plant put up on it. The farm is not yet in full working order.

(10) *Marna farm.*—It has been started by Rai Shiva Parshad Bahadur, Junior Secretary to the Board of Revenue, is about 700 acres in area and is situated on the Jaunpur road, 12 miles from Fyzabad.

For the present 15 acres are put under sugarcanes, 100 acres under paddy crops, and a large area is reserved for the *rabi* crops. In spite of the genuine interest on the part of Rai Shiva Parshad Bahadur, the farm has not yet been put in working order owing to various difficulties encountered.

(11) *Brahmani farm.*—This is 40 acres in area and belongs to the Tiloi estate and is worked under the management of Mr. H. C. Young, the Special Manager, Court of Wards, Rae Bareli, who has introduced a pumping plant and opened a seed dépôt on our lines for the benefit of his tenants and takes a special interest in the progress of agriculture in general.

(12) *Lucknow farms.*—Six farms were started during the year under report, as mentioned below.

I am glad to mention that some of the enlightened members of the Lucknow Bar have come forward to help in the cause of agriculture :—

Serial number.	Name of the farm.	Name of the owner.
1	Salimpur farm ..	Raja of Salimpur.
2	Itaunja farm ..	Raja of Itaunja.
3	Majasa farm ..	M. Muhammad Ali Khan, taluqdar, Malihabad.
4	Mahora Kalan ..	Mr. Sami-ulla Beg, barrister-at-Law.
5	Basha farm. ..	S. Zahur Ahmad, B.A., LL.B., Vakil.
6	Bargawan farm ..	Babu Hari Kishan Dhaun, B.A., LL.B, vakil.

The greatest difficulty which existed in securing some unofficial agency that could take over approved varieties of seeds for multiplication is being overcome through the medium of private farms. The main feature of the scheme is the arrangement by which the private farms shall grow the approved seeds recommended by the circle officer and sell the grain outturns thereof either to the department at the market rate or store the same in their respective seed dépôts for distribution on sawai system under supervision of the District Agricultural official concerned to groups of selected cultivators who will undertake (1) to sow them in a prescribed circle in which the local varieties of those seeds will not be sown, (2) to thresh their crops in a separate yard to avoid risk of any seed being mixed up with the local variety and (3) to sell half of the produce after returning the quantity due under sawai, to the farms concerned, if it be so desired by the respective owners thereof in order to enlarge the stock for issue to various other similar circles next season.

IV.—Seed Depôts and their organization.

The object of these seed dépôts is the replacement of the local inferior varieties of grains by those that have proved more suitable for the locality both as regards yield and quality.

There are in this circle 14 Government seed dépôts and four those of District Boards. The former are financed out of the advance of Rs. 15,000 sanctioned by Government and the latter by the District Boards concerned, under the management of the Assistant Director in charge of the circle.

All these seed dépôts stock and issue only the superior varieties of seeds, any two varieties which are likely to get mixed up are not stocked in one and the same seed dépôt. As a rule seeds are distributed within the radius of three miles from each seed dépôt but in some cases, for the sake of large selected areas, up to six miles.

The total quantity of seeds distributed from the seed dépôts mentioned above during the year under report was 16,343 maunds, viz. 3,265 maunds of *kharif* and 13,078 of *rabi* including 1,500 maunds Pusa 12 wheat, as compared with 14,028 maunds, viz. 2,869 maunds of *kharif* and 11,158 maunds of *rabi* in the previous year. Besides 804 maunds of seeds were sold away on cash price to private farms and various other indentors.

The Government was pleased to sanction an advance of Rs. 30,000 more to meet the existing demand for improved seeds.

Court of Wards, Lucknow, started a seed dépôt at Mohanlalganj on our lines, the seeds for which were supplied by the Assistant Director.

V.—Miscellaneous work.

The following statement shows the sale of improved agricultural machines and implements from the Government Agricultural stations and the district demonstration farms as compared with the total number of those sold in the previous year :—

	1915-16.	1914-15.
Plough	457	385
Chaffcutters and spares	13	11
Other implements	37	30

(*a*) *Boring work.*—The introduction of large private farms created a demand for boring work. The Director was kind enough to place four boring muharrirs under me to meet the existing requirement during the year under report.

The boring done in the wells of Nogawan model farm and the farm of Rajas of Chanlapur and Amethi met with a great success—so much so that it was possible to work the pumping plants consequently put up on these wells.

The success of the boring work done on the Partabgarh and the Benares agricultural stations has not been fully ascertained owing to the constant rains which followed as soon as the boring was completed.

The boring work started in the farms of Mr. Zahur Ahmad and Babu Ramapat Ram, vakils in Lucknow district, was not completed during the year under report.

(*b*) *The agricultural machines.*—The success of the boring work made it possible to grow wheat and sugarcane crops on large scales by using pumping plants and now the demand for threshing and cane-crushing plants will follow.

The threshing plant which was placed at my disposal by the Director, did much useful work on Amethi Farms and attracted the attention of public to a considerable extent.

(*c*) *Agricultural monthly journals.*—There are now two journals, one *Risala Mufidul Mazarine* in vernacular and the other *Kisanopkaark* in Nagri. The latter is chiefly a translation

of the former. They were issued regularly and 87 articles on various important agricultural matters appeared in them during the year under report as compared with 73 appeared in the previous year.

These journals meet the requirements of the people, who are anxious to know what agricultural improvements have been made on the various agricultural stations of the department and that what benefit and how they can derive from them.

(*d*) *Correspondence.*—The total number of letters received and issued were 3,069 and 2,938 respectively during the year under report as compared with those of the last year which were 2,566 and 2,807 respectively.

A large number of demi-official letters issued by the Assistant Director is not included in any of the figures mentioned above. The increase of correspondence shows that the interest of the public in agricultural matters is steadily increasing.

L.C. SHARMA, M.R.A.C., P.A.S.I.,
Barrister-at-Law,
Assistant Director of Agriculture.

PARTABGARH:
Dated the 31*st August*, 1916.

APPENDIX IV.

Report on the administration of the Agricultural College, Cawnpore, for 1915-16 *by* MR. H. M. LEAKE, M.A. (CANTAB.), F.L.S., *Principal.*

Throughout the year the post of the Principal has been held by me in addition to duties as Economic Botanist to Government, United Provinces.

During the year the process of re-organisation has continued uninterruptedly. The last of the students admitted before the re-organisation, 11 in number, left in April after taking the Diploma Examination in which all passed. That the new, and especially the Vernacular, courses appear to be attractive is shown by the numbers of applications received. At the last admission, in October, 1915, the Vernacular course was filled from a total application list of 104 while 10 were admitted to the Four years' Diploma course. Under a resolution of the Governing Body, the College year will in future run from July (when admission will be made) to April, and applications have already been received for the session commencing next July. The Vernacular course has been filled from an application list of 136 while the list of applications for the four years' course included 23 names and will remain open till term commences.

The object of the College has been explained in my last report and in a paper read before the Co-operative Conference held in Lucknow last spring. Numbers alone do little to prove if the College is fulfilling that purpose. What is desired is a measure of the degree of association of the students with Agriculture. Such a measure is given by the revenue paid by the students themselves, by near relatives, or by the estates from which they come, discretion having to be used in estimating the two latter. Using such a test and excluding the representatives of Native States of whom a few are taken, 33 students admitted in Octo ber, 1915, represent a revenue of Rs. 1,59,540, while for those 28 already selected for admission in July, the figure is Rs. 1,32,851.

The above figures rough as they are, will, I think, justify the assumption that the College is fulfilling its purpose in respect to the students and to a degree I, at least, hardly anticipated.

Having thus the material, it remains for the staff, by developing a high class of teaching, to make the most of this advantage. On this matter unfortunately this report cannot be so satisfactory. Largely owing to conditions beyond control, the staff has been reduced to a dangerously weak point. During the year Mr. Wilson, who had been in charge of the Botanical teaching, left the province. It has not been possible for an Agriculturist to be appointed to take over the Agricultural side, the supervision of which has been in my charge throughout the year, and lastly no substitute has been obtainable to replace the Agricultural Chemist in charge of the Chemical section. Thus three out of four gazetted officers connected with the teaching are no longer available. Through the courtesy of the trustees of the Canning College, Mr. Youngman's services have been put at the disposal of the College for two days a week and Mr. Holt has been appointed Warden for a period of one year. Under the circumstances considerable difficulty is experienced in keeping a sufficient standard in the teaching and it is essential to do so if the present class of student is to be maintained.

The organisation of the course under the new system has however been continued, and during the year, a workshop, in which practical instruction is imparted to each student, has been developed. Opportunity has also been taken of the damage done by the rains to replace the old farm buildings (the remains of an old *basti*), by a model farmstead. It is essential, however, if this promise is to materialise, that the framework of the courses which have now been established should be filled in with greater attention to detail than is now possible.

H. M. LEAKE,
Principal,
Agricultural College, Cawnpore,
United Provinces.

APPENDIX V.

Report on the administration of the Botanical section for 1915-16, *by* MR. H. M. LEAKE, M.A., (CANTAB.); F.L.S., *Economic Botanist to Government, United Provinces.*

Charge.—I held charge of the post of Economic Botanist to Government, United Provinces, throughout the year; the services of Mr. Wilson, who has held the post of Assistant Economic Botanist for some years, were placed at the disposal of the Government of India from the afternoon of 21st March, 1916, since which date the post has been vacant.

Research.—Owing to the transfer of the Assistant Economic Botanist and to the fact that I am also in charge of the College including the supervision of the Agricultural teaching, the amount of research work has had to be considerably curtailed.

Major researches. (1) *Cotton.*—The second stage of the work on this crop, reference to which was made in my last report, is proceeding. Two types, K 7 and K 22, have been widely distributed and the latter especially shows every prospect of proving a most valuable field crop.

(2) *Opium.*—As indicated in last year's report, the scope of this investigation has been largely extended. A detailed account of the year's work forms the subject of a report to the Government of India, a brief reference here is alone, therefore, necessary.

The preliminary object with which the experiments were undertaken was a study of the diseases of the poppy plant. These have been studied in collaboration with the mycological section of the Pusa Institute and point to the following conclusions. The wilt of the poppy is mainly a question of cultural conditions and, where these are satisfactory, little loss will arise from this cause. The disease caused by blight (Peronospora) falls into a different category. This disease is universal and largely dependent on the climatic conditions. Different races, however, show marked divergence in their capacity for resisting the disease and the best method for approaching the problem appears to be the selection of such resistant races—a work which is now in progress.

The question of morphine content is much more complex and work in this direction can only be said to have entered the preliminary stages. It forms the subject of the separate detailed report to Government.

Minor researches. (3) *Wheats.*—The work on wheats has been limited practically to the multiplication of a promising selection under the title of Cawnpore 13. The mass of detailed information on the United Provinces indigenous wheats remains unpublished from lack of opportunity to collate the information obtained.

(4) *Barley.*—Owing to Mr. Wilson's departure work on this crop has had to be discontinued. Only sufficient time has been available to carry the cultures forward without record. Loss of material collected has thus been prevented.

Seed farm.—Executive charge of this has passed from Mr. Wilson to Babu Ram Pershad. The season has been very unfavourable, the farm being situated in the Aligarh district in which the rains of 1915 completely failed. Irrigation is from water supplied by the Upper Ganges Canal, the supply of which during the *rabi* season was seriously deficient. The expenditure amounted to Rs. 9,382, of which Rs. 1,563-4-8, was expended on non-recurrent charges, leaving a current charge of Rs. 7,818-11-4. The income amounted to Rs. 9,028-13-7. Two varieties of wheat were grown, namely Pusa 12 and Cawnpore 13, the seed of which will be distributed to cultivators through the Deputy Director, Central Circle, in the *rabi* of 1916-17. Of cotton, two types, K 7, and a new variety K 22, were grown. As has been stated above, the latter appears very promising in yield and 15 bales of the lint derived from it were sold at a premium of over Rs. 5 per maund (desi standing at Rs. 25). Steps have been taken to distribute seed of this type widely.

APPENDIX VI.

Report on the administration of the Chemical section for 1915-16.

During the year under report the teaching staff remained unchanged, Babu Brij Lal Mathur being definitely transferred to the Provinces of Behar. Mr. G. Clarke was in charge of the office of the Agricultural Chemist to the Government of United Provinces. He went on leave on the 7th of June, 1916. He was in charge of the teaching of Chemistry in the Agricultural Department throughout the year. The scope of the course in Chemistry was expanded to meet the requirements of the four years' students. A course of instruction in the elementary principles of Physical and Chemical science with special reference to agriculture was given to the two years' class. This was accompanied by demonstrations in the field and laboratory.

Publication.—A bulletin showing the results of the working of the sugarcane research station at Shahjahanpur was published by Mr. Clarke and an article on improved sugarcane in the United Provinces was written for the Imperial Agricultural Journal.

Sugarcane.—The principal results of the year's working are given in the bulletins mentioned above. The objects which have been kept in view are the selections of the best varieties of indigenous cane to replace the mixed varieties grown in the various sugar tracts on the country and if possible to find a suitable cane from other cane-growing countries to replace existing races. The immediate result of these investigations has been to recommend two varieties, one J. 33 and the other Ashy Mauritius, as most suitable for these provinces; the latter where conditions of intensive cultivation prevail. In all 3,086 maunds of J. 33 were distributed and demonstrations were arranged for in cultivators' plots to popularize this cane. To meet the demand for seed of indigenous cane, 3,331 maunds of selected varieties were distributed. Considerable, assistance has been received from Mr. Simmonds of Carew and Co., of Rosa, who has put down a considerable area with J. 33 and distributed seed to cane-growers of the factory. The results of the test of this cane at the factory were as follows :—50 tons tested on a factory scale in one test with 50 tons of cane in 11 roller mill without maceration before the results were obtained.

Juice expressed for 100 cane	76·6
Sucrose per 100 juice	14·35
„ „ 100 cane	11 78
Purity	82·00
Extraction	85·00

The yield of cane was some six to seven hundred maunds per acre. A fuller account of this cane is given in the article written in the Imperial Agricultural Journal.

Small power sugarcane mills.—A grant was received from the Agricultural Adviser to the Government of India for experiments with small power mills capable of crushing 10 to 15 tons per diem which could be worked with the oil engines now being used in parts of the provinces for water lifting and other purposes. As the result of the preliminary experiments made with the co-operation of Mr. Vick, Agricultural Engineer, a type of mill has been decided on, which is being made by a local firm and which will be tried during the cold weather.

Receipts.—The total receipts of the farm were Rs. 7,200 and the expenditure Rs. 7,500. The farm therefore practically pays for itself and the work is carried on at a minimum cost to Government.

APPENDIX VII.

Report on the administration of Agricultural Engineering for 1915-16 *by* MR. F. H. VICK, M.I.M.E., *Agricultural Engineer.*

The year has been one of considerable difficulty in the matter of obtaining tools and plant for our work, the conditions being even worse than in the previous year. Works in progress have often been held up for long periods through inability to obtain engines, pumps, pipes, pulleys, tube-well strainers, and such like material for our installations. A great many Indian firms are now on munition work and so are either unable to make the smaller details of our requirements, such as pipes, pulleys, tanks, etc., or if they accept the order at all they will not give a date of delivery, and a small order will take months to execute, instead of weeks as formerly. Imported material from England, such as W. I. pipes, engines, pumps, girders, and other rolled sections, is coming out in greatly reduced quantities, the consequence being much difficulty in obtaining such goods and extremely high prices ruling.

Tube-well work.—Progress has been made in this work as far as has been possible in the face of the difficulties previously mentioned. Our operations have been purposely very widely extended through the province, the aim being to prove the possibility of successful tube-wells in any district. We have put down, in the last two years about 30 large tube-wells and these are spread over no less than 20 districts of the province. In no single instance have we had a failure with a tube-well which undeniably proves the suitability of the whole province for this form of well. We have not of course yet reached finality either in the methods of sinking tubes or in the size or yield of our tube-wells, but we are able now to guarantee a successful well giving from 30,000 to 40,000 gallons per hour for continuous pumping, which is certainly some improvement over old wells giving from 2,000 to 6,000 gallons per hour.

Regarding costs of tube-wells, as previously stated the price of everything used on the work has risen enormously, during the past two years, the advance being at least 50 per cent. and in some cases as much as 200 per cent. over former rates. It is therefore a very difficult time to reduce tube-well prices. We have reduced very considerably one item, the costs of sinking the tubes. This work a year or so ago, before we had plant of our own, was costing us Rs. 14 a foot, by contractor's agency, whilst we now do the same with our own plant at a price within Rs. 6 per foot. When we can get back to normal market prices for material we shall be able to reduce prices all round which will bring a tube-well more within reach of the zamindar and land-owner.

The power boring machine received from Australia has proved a very useful machine. It was used on a deep boring in Cawnpore district during last cold weather and despite severe conditions in the way of very hard clays, kankars, and stones it did some very good sinking. It is now at work in Sitapur district, where conditions are a little easier. The results are being carefully watched, so as to be able to know the right type of machine and tools for future purchase, suitable for the work encountered in this province.

Agricultural machinery and implements.—Several power cane-crushing mills have been given trials and I have chosen two patterns of mills as most suitable for extended trials. I am getting a few of these mills made in the province and hope to have some at work during the coming season. The two chosen, small and medium, can be driven from a 7 and a 12-H. P. engine respectively and I have no doubt that owners of engines installed for pumping will soon come to use cane mills, which can be driven from their present engines. As in other lines of work the greatly increased price of mills has militated against their more extended adoption by zamindars.

Flour mills of small pattern are in demand by owners of engines and several have been purchased and installed.

The Cawnpore shops have been engaged in the repair of implements as usual and in making some new types suggested by agricultural officers, for trial.

Mechanical engineering classes for students.—We now have classes six days a week for the College students, a mechanical instructor having been appointed for this work. A little practical knowledge of mechanics is extremely necessary for the practice of agriculture, in these days of increasing use of labour-saving machinery, and I am glad to be able to report on the keenness of the students to acquire knowledge in this line.

Advisory work by correspondence and by inspection and visits.—A great and increasing number of applications are coming in from government officers, zamindars, managers of estates, etc. for advice. Such enquiries include well construction and well improvement, purchase of machinery and water lifts, etc. Advice is freely given to all applicants and in a large number of cases visits are paid to the sites of works and if necessary a mechanical assistant or a borer lent for a time to supervise the work.

CAWNPORE:

The 18*th July*, 1916.

F. H. VICK, M.I.M.E.,
Agricultural Engineer,
United Provinces.

APPENDIX VIII.

Note on arboricultural operations during 1915-16.

New planting was carried out on 70 miles of provincial roads and 153 miles of local roads as compared respectively with 75 and 157 miles provided for in the working-plans. Out of 153 miles planted on local roads 11 miles were planted by private individuals in Fatehpur, Hamirpur, Basti, and Fyzabad.

Working-plan.—Divergencies from the working-plans have occurred in seven districts on provincial roads and in sixteen districts on local roads. Explanations of divergencies in the case of local roads have been received from all districts except one. In four districts trees were planted in excess of the plan either to make up the deficiency of the last year's programme or to help the next year's plantings. In two districts funds were diverted to filling up gaps and in another two districts the plan was revised. In six districts full amount of work could not be done for some defects in the management of nurseries or supervision. In one district shortcoming was due to drought. The planting of unsuitable trees has almost ceased in the provinces the only case of importance being the plantation of 124 *sirís* trees on local roads in the Banda district.

Extension of avenues.—Further cases of paper avenues have come to light, notably on the local roads of the Shahjahanpur and Lucknow districts, where 26 and 32 miles respectively have been struck off. For the province, as a whole, 75 miles, misclassified as avenues, have disappeared from the list; while 328 miles of recent plantings have been classified as "established," that is requiring no further protection.

Training class of supervisors.—No training class for supervisors was held during the year as the number of trained candidates on the list already exceeds the needs of the district boards of the province.

Financial results.—The receipts on provincial roads rose from Rs. 29,951 to Rs. 33,970 and the expenditure fell from Rs. 76,148 to Rs. 73,371. The net cost to Government was thus Rs. 39,401 as compared with Rs. 46,197 in the preceding year. The receipts on local roads were Rs. 64,718 or Rs. 6,242 in excess of the last year's receipts while the expenditure fell from Rs. 1,26,648 to Rs. 1,23,396.

L 41404.

REPORT

ON THE

ADMINISTRATION OF THE DEPARTMENT OF AGRICULTURE

OF THE

UNITED PROVINCES OF AGRA AND OUDH

FOR THE YEAR ENDING 30TH JUNE, 1917.

ALLAHABAD:

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(Prescribed maximum limit of the report, 20 pages.)

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Glossary of crops mentioned in the report.

English or vernacular names of the crop.	Botanical names equivalent to the English or vernacular names.
1. Gram	Cicer arietinum.
2. Bajra	Pennisetum Typhoideum.
3. Paddy	Oryza Sativa.
4. Juar	Sorghum Vulgare.
5. Groundnuts	Arachis hypogaea.
6. Sann-hemp	Crotolaria Juncea.
7. Arhar	Cajanus indicus.
8. Bhusa	Straw (English).
9. Kharif	Autumn harvest.
10. Rabi	Spring harvest.
11. One seer = 2 lb.	
12. One maund = 82⅔ lb.	
13. Kapas	Gossypium Neglectum.
14. Uk	Saccharum Officinarum.
15. Reora	A kind of sugarcane.
16. Pounda	" " "
17. Khandsaris	Professional sugar-boilers.

Report on the Administration of the Department of Agriculture, United Provinces, for the year ending 30th June, 1917.

No. 4/V—201B.

FROM

THE HON'BLE MR. H. R. C. HAILEY, C.I.E., I.C.S.,
DIRECTOR OF LAND RECORDS AND AGRICULTURE,
UNITED PROVINCES,

To

THE CHIEF SECRETARY TO GOVERNMENT,
UNITED PROVINCES, REVENUE DEPARTMENT.
Dated Lucknow, the 2nd October, 1917.

SIR,

I HAVE the honour to submit the report on the administration of the Department of Agriculture for the year ending 30th June, 1917.

CHAPTER I.

ADMINISTRATION.

Officers of the staff.

2. I held charge of the department throughout the year. Mr. H. M. Leake held the post of Principal, Agricultural College, Cawnpore, throughout the year in addition to that of Economic Botanist, except for the last three weeks of June, 1917, during which he was on privilege leave. Mr. A. W. Fremantle, on his return from long leave on 16th November, 1916, was appointed on special duty in connection with investigation into the reclamation of ravine lands in Bundelkhand and the Agra and Muttra districts, which post he held up to 22nd June, 1917, when he went on extraordinary leave without allowances for two months. Mr. B. C. Burt remained in charge of the Central Circle for the whole year. The services of Dr. A. E. Parr being still at the disposal of the Government of India in the Army department, the officiating charge of the Western Circle was held by Rai Saheb Babu Ganga Prasad in addition to his own duties of Divisional Superintendent.

Mr. L. C. Sharma was in charge of the Eastern Circle during the whole of the year.

Mr. G. Clarke has not yet returned from long leave and his work at the college has been carried on by Pandit Tej Shankar Koohak.

The post of the Assistant Economic Botanist has not yet been filled up. Mr. W. N. Harvey remained in charge of the North-Eastern Circle for the whole year. Pandit Nand Kishore Sharma held one of the two posts of Divisional Superintendent sanctioned during the year under report.

3. The post of the Agricultural Engineer was held by Mr. F. H. Vick throughout the year.

4. Khan Bahadur Mir Saiyid Husain, Personal Assistant, returned from privilege leave on the 18th July, 1916, relieving Babu Mohini Mohan Lal, Deputy Collector, who succeeded him permanently from 11th June, 1917, consequent on the former's retirement.

5. The term of the appointment of Mr. W. Hulme, Sugar Engineer, has been extended up to 31st March, 1918. He took over charge of his duties at the Nawabganj sugar factory on 9th November, 1916, and completed the season's work on 7th April, 1917.

6. The services of Mr. H. E. Annett, Agricultural Chemist to the Government of Bengal, were placed at the disposal of the Government of these provinces in September, 1916, in connection with experiments on the improvement of the morphine content of poppy, and he held charge of his special office up to the end of the year.

7. Sanction was received from Government during the year for the filling up of two posts of Sub-Divisional Superintendent, and Rai Ganga Prasad and Pandit Nand Kishore have been appointed. It is intended that these officers shall take charge of outlying groups of districts situated at a distance from the headquarters of the circle, which, under present conditions, cannot be adequately looked after by the Deputy Director. As the cadre of the department is increased, these areas will probably be formed into separate circles, but in the meanwhile the appointments will take a good deal of routine work and correspondence off the hands of the circle officer. They will also provide for leave vacancies. Pandit Nand Kishore has taken charge of the Bundelkhand sub-division.

Developments.

8. With a depleted staff no new developments could be undertaken, and in some branches it has not been possible to do much more than keep things going. In addition to the inadequacy of the staff, there have been other difficulties in the shape of scarcity and high prices of all iron work, which have not only greatly hampered the work of the agricultural engineering department but interfered with the supply of machinery and implements of all descriptions. This applies not merely to the pumping plant and more expensive machinery required for the private farms, but to the simpler forms, such as ploughs and harrows, the use of which it is hoped to popularise among the cultivators.

9. With the aid, however, of the allotment from the wheat grant received from the Government of India, it has been possible to make arrangements for the extension of work in the future. Land is being acquired for much needed seed farms in three circles, which will afford material assistance in seed distribution and are necessary for maintaining purity. Experience has shown that seed is very liable to become mixed on the threshing floors and, unless centres of purity are maintained, the crop too becomes mixed and quality deteriorates. Once started and in working order, these farms will involve no additional expense to Government.

10. Another portion of the wheat grant will be devoted to assisting zamindars in protecting dry and precarious areas, particularly those in which well construction presents special difficulties. There are certain definite tracts in the provinces in which the soil is light and sandy and, owing to the nature of the subsoil, the ordinary form of well yields but little water. The trials so far conducted seem to show that with tubular wells these tracts can be converted into fine wheat-growing lands and brought under intensive cultivation. In the instance quoted in appendix 7 to this report, 104 acres of poor dry land were brought under wheat and 33 under sugarcane, in spite of the very great wastage in carrying water over a sandy soil in unlined channels. Similar success was obtained in the Budaun district, where a considerable area of land that had hitherto grown mainly *bajra* was brought under wheat. In both cases, if arrangements could be made for masonry channels, the area commanded would be much increased. It would appear that the value of what are known as the "bhur" tracts in the central districts could be greatly enhanced by the spread of irrigation from this form of wells, and that in time much of the areas would be brought under high cultivation. Progress in this direction has been hampered by the difficulties in procuring plant. Arrangements have, however, been entered into with some of the zamindars for work in the future, and the additional funds placed at the disposal of the Agricultural Engineer will enable him to purchase power plant which will ensure speedier construction.

11. Private enterprise has stepped in to materially aid the department in many branches of its work. Not only has there been an increase in the number of private farms opened on large estates working in conjunction with the department, but there has been also increased readiness on the part of shareholders in coparcenary villages to place their *sir* land at the disposal of the department for demonstration purposes. The bulk of the private farms are in

Oudh where, owing to the nature of the land tenure, it is easier to arrange for compact areas. But a certain number of the farms are also springing up in the estates of larger proprietors of the Agra province, and several court of wards estates have opened seed and demonstration farms. Zamindars in coparcenary villages can rarely arrange for establishing anything in the nature of a farm, owing to the scattered nature of their property, but many are doing useful work in giving up plots of the land retained for their own cultivation for demonstration work. These farms and plots have materially facilitated demonstration and extended it over wider areas. They have also proved most useful for multiplication and distribution of seed of selected varieties. The Oudh farms have supplied large quantities of seed, mainly Pusa wheat, to the tenants of the estates, and the rapid spread of this wheat through part of the provinces is largely due to their agency. Perhaps, however, their main value is indirect rather than direct. The owners are men of capital and are in a position to show what can be done on holdings of an economic size, properly cultivated and irrigated. They thus set a standard for smaller men to follow. Demonstration plots show the value of particular crops and methods of cultivation. It must, however, be pointed out that, valuable as these private agencies are, they do not obviate the necessity for establishing centres of work of the Agricultural department in districts where no agricultural station at present exists. It has been found necessary, in order to extend the work and influence of the Agricultural department, to have one such centre in each district, which will be the headquarters of the Inspector to whom applications for seed, implements, and other forms of assistance can be made. The policy, therefore, of establishing a district farm in each district is being kept in view and will be developed as circumstances permit.

Field man staff.

12. Sanction was received from the Government during the year for increasing the cadre of fieldmen. Additional men have accordingly been appointed to each circle, mainly for various forms of demonstration. It has also been possible to keep a reserve of trained men to meet the requirements of those desirous of opening private farms. This class of men have proved satisfactory workers and are being entrusted with much of the demonstration work of the department.

CHAPTER II.

Agricultural Education.

Agricultural College.

13. The staff of the Agricultural College was again below its normal strength. Temporary arrangements were made to relieve Mr. Leake, the Principal, on whom the main burden of conducting the teaching fell. Mr. Youngman of the Canning College, Lucknow, came over for two days in the week to supervise the course in botany; while Mr. Annett, officer on special duty in connection with opium investigations, assisted in supervising the teaching in agriculture. The staff of lecturers has been strengthened by the appointment of two new lecturers to meet the growth of the classes. The new boarding house was opened during the year, and all the accommodation taken up.

14. Considering that the reorganisation of the college dates from 1914 and has been carried out in face of great difficulties, due to the inadequacy of the staff, the progress made must be considered satisfactory and it has been rendered possible by the readiness and good will with which the college staff has undertaken the extra work thrown upon them. The total number of students on the 31st of August was 113, of whom 54 were in the collegiate or four-year course, and 59 in the two-year or vernacular course. Both courses have been filled without any difficulty and applications for admission have been in excess of vacancies. The entries for the four-year course which, it was not anticipated, would prove attractive until the value of scientific agriculture was more fully appreciated, were double those of the previous year. From the number of applications received during the present season it would appear that the class will again be complete. The two year course since its initiation has proved popular, and in 1916 there were 146 applications for 25 vacancies. It is clear that there is a demand on the part of sons of the zamindars of the college-going age for education in practical

agriculture, whether the aim in view be to farm their own land, or to take service in the Agricultural department, the life in which is likely to prove congenial. The latter can absorb only a small proportion and course was instituted in the anticipation that the majority would take up agriculture on their own account. The revenue test indicates that the students now going through the course are connected with landed property of some extent, and it may reasonably be hoped that a proportion will use the practical knowledge they have acquired at the college for the improvement of their property. Attention has already been drawn to the interest taken by a certain section of the proprietary community in agriculture as a pursuit, of which the tangible result has been the establishment of private farms on their estates, and the two-year course affords an excellent means of acquiring the necessary training for working them.

15. It is at present too early to speak about examination results, since none of the four-year students have yet passed out. The examiner reported favourably on the training received in agriculture by the two-year students, though results in chemistry were not so good. Nor can anything yet be said about the openings for employment for the four-year students. It may, however, be mentioned that a fair number of applications have been received for teachers in agricultural subjects which it has been difficult to comply with. The employment bureau started by the Principal has been successful in obtaining employment for the two year students who have passed out, the majority of whom, for special reasons mentioned in his report, entered the college in hopes of obtaining service.

Horticultural Education.

16. The overseer class is now extinct. The two remaining students of last year having completed their course were appointed to gardens in the provinces. Both the *chaudhri* and *mali* classes were full. The former do excellent work in imparting a sound knowledge of horticulture to a body of intelligent and educated young men, which fits them to undertake management of private gardens and less important Government posts. There has been no difficulty in obtaining employment for them. The demand for *malis* continues in excess of trained candidates. Owners of gardens are encouraged to send their own men for training to the gardens. The results of this system have so far proved satisfactory and the men are well spoken of by their employers after they have been through a course at the gardens.

CHAPTER III.

Research and Experiments.

Poppy.

17. These branches of work were necessarily restricted by the shortness of the staff. Mr. Leake, the Economic Botanist, was without an assistant and also in charge of the college which made great demands on his time. In conjunction with Mr. Annett, Agricultural Chemist to the Government of Bengal, whose services were lent by that Government, he conducted investigations into the increase of morphine content of opium; a subject which has assumed considerable importance, owing to the cutting off of the Turkish opium. Valuable results have been achieved indicating a means of obtaining, by some alteration in the method of collection, a morphine content fully up to the requirements of the British pharmacopoeia. Races of poppy have also been isolated which promise to give a uniformly higher content than those ordinarily grown. Investigations are being continued and results so far obtained are under publication. The full solution of the problem should lead to the development of a valuable industry in these provinces.

Cotton.

18. Lines on which research are being conducted in connection with this crop were described in last year's report. The season was most unfavourable for any form of work of cotton. The increase in the area sown from 8,21,059 to 11,74,249 acres showed a return of interest in this crop after the very indifferent prices of 1914-15, but the crop itself was a poor one. Persistent rain throughout the growing period and heavy downpours in September proved disastrous to the yield. These conditions were particularly unfavourable to the quality cotton crop. American cotton did not do well, and trials of Mr. Leake's hybrid K. 22 were necessarily inconclusive.

19. American cotton laboured under the farther disadvantage of having a competitor in the shape of indigo. The area under early sown cotton was short, and at least 50,000 acres which would normally have been put under early cotton were sown with indigo. The sudden jump in prices, when the poor character of the crop was realised, induced cultivators, who had sown American cotton, to sell their *kapas* as *deshi* and a good deal of this lint never came into the buying dépôts of this department. The total quantity bought in was only some 150 bales, the bulk of which was taken by the Muir Mills and a smaller quantity by a Hathras Mill. The premium paid by the former amounted to Re. 1-4-0 per maund over *deshi kapas* which, considering the inflated price of the latter, brought in handsome profits to the growers. The conditions were thus generally unfavourable and the season threw no light on the probability of the extension of this crop in the future. Apart from any question of securing preferential prices for the better quality of lint, it is essential that arrangements should be made for an adequate supply of canal water in the sowing period. A scheme has been worked out with the Irrigation department which was tried this year and, it is hoped, will assure the growers a sufficiency of water. Experimental work on this crop took the form of isolating pure races from the mixed cotton known as Cawnpore-American, and several have been selected which are superior to the original crop in yield, quality and ginning percentage.

20. Of selected *deshi* varieties, Aligarh white flowered continues to be the most popular and is cultivated over a wide area in the western districts. Its undoubtedly hardy character commends it to the smaller growers of these provinces, to whom the possibility of higher prices from a longer staple cotton appeals less than an assured outturn from an inferior type, less expensive to grow. So long as this type commands its present premium, on account of its high ginning percentage, it will remain popular among the cultivators who have benefited financially by its introduction. A selection has been made from local Bundelkhand cottons which has been well reported on and may prove suitable for general introduction into that area.

21. One of the most pressing needs for the improvement of cotton generally in these provinces is the appointment of an entomologist. It is only necessary to look at the lint as it comes on to the market to form some idea of the extent of the loss suffered from the pink boll worm *(gelechia gossypiella)*. There is a considerable proportion of stained lint and the damage done in destruction of bolls must be great. The heaps of cotton standing in the ginneries may often be seen infested with the worm. It is possible that nothing short of the control of seed in the ginneries will be effectual to check this pest, but whatever is done should be carried out under the direction of an expert who has an opportunity for closely studying local conditions. Cotton was not the only crop which suffered from insect pests during the year ; both rice and cane being attacked with unusual severity. The latter in parts of Rohilkhand was reduced to such an extent by the borer that some of the fields were ploughed up for the *rabi*. There would be ample scope, therefore, for a branch of economic entomology in the department.

Sugarcane.

22. Mr. Clarke, the Agricultural Chemist who is in charge of the experimental sugar farm, was on leave throughout the year. The work in connection with this crop was on the lines indicated in last year's report, viz., it was directed towards the improvement of existing methods of cultivation, and the introduction of varieties recommended from the research farm. The former is the more pressing problem, as it is little use putting out better class varieties found satisfactory at the Shahjahanpur farm, or any recommended from the Coimbatore station, until more intensive cultivation is generally adopted. When it is, the heavier yielding kinds of medium thickness will probably be found most profitable.

23. The system followed has been to supply manure, or seed, to owners of demonstration plots on condition of their cultivating the crop on the lines prescribed. The number of these demonstration plots is increasing annually and some of the owners obtained fine crops of J. 33 and *deshi* varieties. The season was not however a favourable one for the crop, as there was shortage of canal water during the hot weather months and the crop was waterlogged in many parts throughout the monsoon period. A certain group of canes suffered severely from smut.

24. Low prices of *gur* before the war tended to depress the crop, but since 1914 they have risen materially and careful cultivators have realised good profits. One of the causes of neglect in the past was undoubtedly the small profits obtained by the average grower, but the crop is now coming back into favour. There is a keen demand for cane seed from all the farms and a willingness to try any new kind—possibly, too, there was in some cases disappointment that the new kind of seed cultivated in the old way has given no great results. At the same time the more enterprising class of cultivators are devoting attention to the better cultivation of the crop, and there are other agencies at work making for a general improvement. The two principal sugar manufacturing companies of the provinces, viz., the Rosa and Tamkohi factories, not only grow cane themselves but in various ways assist their growers. Some of the private farms have been very successful both with J. 33 and *deshi* canes, and have got outturns at least double those ordinarily obtained by the cultivators. The knowledge that good profits are realisable have led others to start cultivation on some scale with a view to establishing *gur*-making factories, which will be opened as soon as plant is available. In the meanwhile arrangements are being made for regular irrigation. Where progress depends primarily on better and necessarily somewhat more expensive methods of cultivation, it takes time; and cannot proceed at the same pace as in case of other crops, such as wheat or cotton, where little or no change in methods may be required. But the increasing interest taken in the crop by men who are capable of putting money into its cultivation is a hopeful sign for the future.

25. Experiments were made at different places with sealing the ends of the seed cane, as a protection against white ants, with rosin obtained from the Bhowali turpentine factory. The loss in some parts of the provinces from this pest is very great. Reports as to the efficacy of the treatment differ; the insects in some cases attacking the eyes. Best results were obtained when combined with the common method of smearing the sets with some substance objectionable to the insects.

26. The experimental sugar factory at Nawabganj designed by Mr. Hulme was worked for part of the season. The cane crop in the neighbourhood was, however, a thoroughly bad one and the supplies of cane were insufficient for keeping the factory running for more than a short time. Much of the cane, too, brought in was diseased. No report is accordingly being published of the season's working. Engagements have been entered into with cultivators which, if the coming season is a normal one, should provide sufficient supplies for a full trial of the plant. This factory has not attracted the attention it merits; possibly owing to the difficulties of access and of finding accommodation in the neighbourhood. Those who are putting down cane on any large scale must employ mechanical power for crushing and, before deciding on the form of plant, would do well to visit this factory.

Wheat.

27. Pusa Wheat no. 12 has passed beyond the experimental and demonstration stage, and the main work in connection with it is the organisation of the seed supply for its extension over compact areas. This is being carried out through the agency of Co-operative Societies, private farms, and seed dépôts of the department, according to the circumstances of the locality. It is difficult to obtain figures of the area under this crop; but last season it did not fall short of a lakh of acres. In the coming season this area will be considerably increased; a portion of the wheat grant having been set aside for buying in seed for distribution. The type does best in the central districts and, as it gives a definite increase of yield above *deshi*, its expansion will raise the total provincial production. Being beardless and shedding its grain somewhat readily, it is not so well liked in the submontane districts for which an improved type is still to be found. Trials of the classes most suitable for Bundelkhand are still being carried out; the diversity of conditions in this tract rendering selection a somewhat difficult matter. Mr. Leake's C. 13, a strong strawed wheat with good milling qualities, has been tried with success at different centres and is likely to prove a valuable addition to the provincial wheats.

28. It has not been possible to undertake much experimental work on other main crops, that on barley being temporarily dropped. Experiments on tobacco

and flax were continued in the central circle: some varieties of the former crop issued from Pusa are proving satisfactory. The farm opened at Gorakhpur has not proved very suitable for rice experiments. It is proposed to take up a special area for this purpose.

Demonstrations.

29. Operations in connection with the introduction of new varieties centre mainly round the organisation of seed supply. If they suit the cultivators they spread quickly enough, provided the seed is forthcoming. Demonstration work is concerned rather with the introduction of better methods of cultivation, use of manures, and implements, improvement of poor land, eradication of deep weeds, preventive measures against insect pests, etc.—in other words the general work of the department towards the betterment of agriculture. The various methods adopted are determined mainly by the character of the demonstration. In case of sugarcane, demonstrations are usually made on cultivators' plots, who are assisted with manure or seed on condition of their undertaking to sow and cultivate the land under the directions given. This is the most complete form of demonstration; as it comprises preparation of the ground, manuring, irrigation and cultivation of the crop. In other cases demonstrations are given to the value of cake manures such as *mohwa* cake, or green manuring. Implements are often lent in the first instance, the borrower buying if satisfied with them.

30. Among miscellaneous demonstrations may be mentioned those of the employment of lever harrows on wheat, to break the crust after watering with a view to reducing excess irrigation. The Irrigation department are assisting in these demonstrations, but, at present, the harrow is too expensive for general use. In the central circle Mr. Burt has been demonstrating the growing of wheat after *juar* for fodder, and improved methods of *dofasli* cultivation of wheat after maize. If generally adopted, these methods would materially add to wheat production. In the eastern circle where the seed rate of wheat is most excessive and involves unnecessary expenditure, demonstration has been given, mainly on private farms, of the optimum rate of sowing with reliable seed. Mr. Sharma computes that the saving of 16 lakhs per annum might be effected in his circle by reduction of the rate to that found sufficient in Government and private farms.

31. It has been shown that some of the milder *usar* lands of the provinces can be successfully treated, provided sufficient quantities of water are available for washing out the salts. The canals of the provinces being strained to their utmost in providing water for the land actually cultivated, have no surplus for this purpose. Where, however, water stands near the surface and can be lifted cheaply by mechanical means, reclamation is found possible and should pay. An area of 100 acres was taken over in the Sultanpur district, part of which has been reclaimed by washing, draining and deep ploughing and will shortly be fit for handing over to the cultivators. The conditions are such as are met with over a large part of Oudh and further demonstrations will be given.

32. Demonstrations of steam ploughing with a tractor plough were given in the Tarai and Bhabar Government estates, where about 100 acres were ploughed and cross-ploughed for wheat growing. The small size of the fields and objections to interfering with boundaries militate against the use of such plant over most of the provinces, but it seems likely to prove useful in tracts, such as Bundelkhand and the Tarai, where land has gone out of cultivation owing to the spread of deep rooted weeds.

CHAPTER IV.

ASSISTANCE TO THE PUBLIC.

Distribution of seed.

33. The various organisations for distribution of seed continued fully employed during the year. The demand is most insistent, and the majority of the dépôts were cleared out of seed some time before the sowing season commenced. In all, some 50,000 maunds of seed were sold from the department's stores, of which 24,045 were sold in the eastern circle and 17,630 in the central circle. These are apart from sales from private seed and demonstration farms of which no record is furnished. There would appear prima facie ample room for the establishment of seed stores as commercial concerns to relieve the department

of much of this work which takes up an undue amount of its officers' time; but, as has been previously pointed out, the agriculturists of these provinces, as a body, have not been educated up to the point of paying more than the food grain rate, even for seed which they have good reason to believe to be reliable. Under such circumstances a seedsman's business would not offer the same attractions as in countries more advanced agriculturally, and the department must continue to rely largely on private agencies which are not primarily aiming at profit. The number of these is rapidly increasing and the farms of the larger landowners have been established with the main object of supplying good seed to their tenants. In view of the prevailing climatic conditions, under which even careful cultivators may find their seed damaged at the end of the rains, the advantages of such supply organisations are very appreciable. A special grant was made by Government to enable the department to provide wheat seed for the inhabitants of the Ganges and Jumna valleys, much of whose property was destroyed in the floods of last year. The seed was given against *takavi* advances, the whole amount of which was repaid after the *rabi* harvest. Operations will be on a larger scale during the current year, as heavy stocks have been laid in to meet the anticipated demand in the districts where damage was done to the grain on the threshing floors by rains in May.

Sale of implements.

34. Sales of implements declined owing to high prices and restricted imports. There was a steady demand for ploughs and the Deputy Director, central circle, notes a tendency on the part of the wealthier cultivators to purchase larger and better ploughs.

Fruit.

35. The Chaubattia fruit gardens have been further developed and will shortly be in a position to supply young trees to growers on a large scale. Various problems such as the provision of packing cases, transport, bottling of fruit, making of jams, have been examined. When the necessary sawing plant is secured, the Forest department will be in a position to supply the industry with the wood required for packing cases.

Well-Boring.

36. Owing to scarcity of plant this branch of work has been further restricted. The price of pipes showed a considerable rise and zamindars were unwilling to incur the cost of putting them down in their wells. The total number of existing wells bored was 573, compared with 667 in 1916 and 1,085 in the preceding year. Opportunity has been taken to further reduce the number of borers employed in districts in which handboring promises little chance of success, and to confine operations to those districts in which water level is nearer the surface and a clay foundation for wells is generally to be found. This will permit of more concentration, and facilitate supervision which, when borers were scattered over a great number of districts, has always been a difficulty.

37. There continued to be a demand for borers from owners of private farms who were anxious to improve the water supply in their wells, and for this purpose the services of a certain number were made over to circle officers who supervise their work. Private enterprise has not yet been sufficiently developed to enable the zamindars to procure borers to improve the well supplies, even in areas where these operations present no great difficulty. A certain number of borers were also employed in sinking the form of well which Chaudhri Rai Amar Singh's work in the Bulandshahr district is rendering popular, where suitable conditions for its installation exist. A pipe of some size is sunk to water level and water is pumped directly through it without the construction of a well. Several of these have now been put down in Oudh and are giving large quantities of water. The advantage is that the cost of constructing a well is obviated, and the money that otherwise be spent on this object can be devoted to the purchase of an engine and pumping plant. Towards the end of the season, scarcity of plant rendered it necessary to suspend these operations, except where zamindars could make their own arrangements for pumping plant.

38. Shortly before the commencement of the war, a strong demand for oil engines and pumping plant sprung up in those parts of the provinces in which improved wells gave a sufficient supply to stand pumping by mechanical power. Efforts were made to keep up a supply of engines and pumps and the department undertook to arrange for their repair. It has been necessary to discontinue their

sale, owing to the reduction of imports. The pumping plant installed is still looked after and continues to do very useful work in areas not commanded by canals. Judging from the number of applications received, there will be a big demand for oil engines as soon as the normal conditions return; as many of those previously installed have amply repaid their owners, particularly where employed for irrigating indigo and sugarcane.

Agricultural Engineering.

39. An account of the working of the Agricultural Engineering is given in appendix 7. The difficulty of obtaining plant has been much more acute during the year and the work has been carried out on a limited scale. Prices, too, have been so high that zamindars preferred to wait until after the war before putting down tube wells. The latter have been worked with success in many parts of the provinces and orders have been received which will keep the department employed for some years. They have proved suitable for certain tracts of country which have hitherto been without irrigation, owing to difficulties of well construction, and have been under irregular cultivation in consequence. Wells in Hardoi and Budaun districts sunk in tracts of this description are giving ample supplies of water. One large pumping plant has been put up in the estate of the Hon'ble Nawab Muzammil Ullah Khan which lifts 120,000 gallons of water per hour from a tank and will bring the adjoining land under regular cultivation. Another large plant working from the Gomti will similarly benefit some poor high land in the Sultanpur district.

40. Efforts have been made to obtain definite figures of cost of working such plant with a view to ascertaining the profits realisable. The difficulty in all cases was found to be that the land at once went up greatly in value and rents sometimes doubled or trebled. The cultivators were thus not in a position to pay a sufficiently high water rate to meet interest and depreciation on the plant. This difficulty does not arise where zamindars themselves have put down wells, as they receive their return in increased rents. Where, however, they have been put down for Co-operative Societies, it has not been possible at first to do much more than pay for running cost, though as cultivation becomes more intensive holders of the land benefited will probably be prepared to pay more for water. In one instance Mr. Burt was able to arrange with the zamindars to pay a voluntary rate of Rs. 2 per acre to cover the interest and depreciation.

CHAPTER V.

MISCELLANEOUS.

Co-operative Societies.

41. Modern conditions of agriculture no longer permit of the village being self-sufficing in the matter of implements and manures. The demand for new varieties, new kinds of implements, and commercial manures compel the cultivators to look beyond the primitive trade which supplied his needs in the past. The absence of any organised markets for their supply, even in towns, offers an obvious opportunity for co-operative activity. Some of the Co-operative Societies of these provinces have undertaken to supply the seed and in the central circle, where they receive every encouragement from Mr. Burt, are storing the varieties mostly in demand. Mr. Burt notes in appendix 2 the nature of these operations. So far few of the societies have been able to undertake the actual buying in of the produce and the majority distribute seed supplied by the department. The Hardoi, Sandila and Jaswan banks have been able to buy and store considerable quantities of Pusa wheat seed themselves. A beginning was made with the sale of implements on commission, but difficulty in procuring stock has brought this business temporarily to a standstill. Considering that this branch of work, viz., that of a supply association, is a new one to the societies, progress made has been satisfactory and it is as well that they should feel their way cautiously. In the matter of supply of water from tube wells and pumping plant, the difficulties in the way of equitable distribution, prevention of wastage and realisation of water rate, proved rather too much for the societies concerned, and the management is being continued by the department until smoother working is ensured. An enquiry undertaken into the marketing of cotton showed that the

majority of the growers were small men who do not bring their own cotton into the markets, but sell in the village to middle men. These growers did not get the full benefit of the high prices reached last year. The remedy must be some form of joint sale among smaller growers, which will enable them to deal directly in the larger markets and ensure them full prices.

Court of Wards Estates.

42. The department has again received much assistance from the Courts of Wards. The Sitapur, Rae Bareli and Kheri estates made their own arrangements for demonstration, storage and distribution of seed. The first named district is putting down tube wells which will protect a large precarious tract. The Harchandpur and Rampur estates have set aside land to be laid out and worked as demonstration and seed farms. Both are well situated for cotton growing and should be useful in introducing any improved varieties.

Agricultural Exhibitions.

43. Sixteen Agricultural Exhibitions were held in different parts of the provinces. They were for the most part well attended and good exhibits of agricultural produce were shown. Opportunity was taken to exhibit the working of implements and machinery; vernacular lectures were given on agricultural matters which were illustrated, where possible, by lantern slides. A new departure was made in the attendance by the invitation of an agricultural assistant at the Kurmi Sabha of the Cawnpore district to lecture on agricultural subjects. These exhibits and lectures were useful in stimulating interest in improvements.

Receipts.

44. The receipts of the Agricultural department for the year amounted to Rs. 95,920; in 1912-13 they amounted to Rs. 39,216. There has been a steady rise each year in succession. In view of criticisms offered regarding the receipts of the department, it may again be pointed out that the seed farms of the department, from which most of the revenue is drawn, are run not from a view of profit making but for certain definite objects which are not necessarily the most paying. The crops grown are not those which would prove most profitable in general farming, but are selected for the production of the kinds of seed most in demand by the cultivators. It is intended, however, that the farms shall pay their own way. In all cases, farms, other than those run for experimental purposes, have done so.

Agricultural Publications.

45. The following bulletins were issued during the year under report:—

Bulletin no. 36 Hints for the Cultivation of Roses.
Do. „ 37 Notes on the History, Uses and Cultivation of the Papaya.
Do. „ 38 Notes on Oranges and Lemons.
Do. „ 39 Notes on Lawns by H. J. Davies, Superintendent, Government Horticultural Gardens, Lucknow.

The vernacular papers and pamphlets issued and articles written for the Agricultural Journal of India during the year under report are detailed in Appendices II and III.

I have the honour to be,

SIR,

Your most obedient servant,

H. R. C. HAILEY,

Director.

APPENDIX I.

Report on the administration of the Western Circle of the Department of Agriculture, United Provinces, for the year 1916-17 *by Rai Sahib Babu Ganga Prasad, Officiating Deputy Director of Agriculture.*

The circle was in my charge throughout the year. As reported in previous year, the circle has agricultural stations in the following districts:—Aligarh, Bareilly, Agra, Muttra, Bulandshahr, and Saharanpur.

District work.

Cotton.—There was a strong demand for white-flowered cotton which was distributed on a limited scale. Districts such as Muttra and Agra where no indigo is grown are prepared to take very large quantities of this seed. Offers at the high rate of Rs. 8 to 10 per imperial maund were made at sowing time. The cotton continues to command a good sale and private seed agencies distributed considerable quantities of seed.

Buri cotton.

The year under report was unfavourable for this cotton. The outturn was smaller than that of country cotton, the price of which was unusually high. For these reasons Buri has declined in popularity. Arrangements have, however, been made in canal-irrigated districts by the offer of irrigation facilities for sowing in the following season. Some of the larger zamindars continued to prefer this cotton and are prepared to go on sowing it. It must, however, be recognized that the cotton has received a set-back although the produce was purchased at high prices. It was sold partly to the Muir Mills and partly to Messrs. Ram Charan and Har Charan Das, Cotton Spinners, Hathras.

Sugarcane.

Sugarcane seed was distributed from all the farms in the circle. Several big indents were supplied from the Shahjahanpur farm also by rail, J33 seed was obtained from that farm for the Bareilly farm also as the crop at the latter farm had suffered seriously from smut and on account of excessive rains had not developed well. The chief demand from the districts was for the seed J33, Mauritius poundas, Saretha, Reora, and Uba. Demonstration plots were arranged in Etah, Budaun and Bareilly by supplying seed free of cost or at a nominal cost. The crops on such plots are reported to be doing well up to this time. The cultivation of superior *gur*-making varieties and of the chewing canes is extending extensively round the oil engine installations supplied by this department, and the demand from other canal-irrigated places was considerable. The demand for the provincial white canes like the reora was greater in Bareilly than the previous year; but it could not be met as the greater part of the farm produce was given to Mr. Hulme's Sugar Factory. In the Bulandshahr district the uba was in special demand as it was found in that district to produce *gur* of a good quality. The saretha was in demand in Agra and besides the Agra farm produce, a big consignment was despatched from Aligarh. The red-striped Mauritius pounda was seriously attacked by red rot at the Nawabganj (Bareilly) Farm and at the private farm of Mr. F. Welsh at Izatnagar.

In order to stop the disease the crop was removed from the field from both the farms before it matured, and its fresh seed was obtained from Shahjahanpur Farm, where the crop was healthy.

Wheat.

One thousand four hundred and fifty-two maunds of Pusa wheat no. 12, 364 maunds of the Muzaffarnagar and 66 maunds of other varieties of wheat were distributed from the various farms. Large quantities of Pusa no. 12 were distributed direct by the private seed centres established through the activity of this department. The Pusa no. 12 is now well known and cultivated where its seed is available in preference to the local wheat, except in certain localities where pigs and birds do damage to it or where labour is scarce for harvesting it, as the grain falls down from the ears which are beardless, if high winds blow when the crop is ripe. Harvesting cannot on this account be delayed. During the year under report the cultivators in Muttra district where labour was scarce at the harvesting season while admitting superiority of Pusa 12 in point of yield took Muzaffarnagar wheat in preference. In the Saharanpur, Bulandshahr, Aligarh, Etah, and Budaun districts the growers have preserved most of the unwetted Pusa 12 wheat for use as seed during the ensuing *rabi*. Arrangements have been made by the department by which large quantities of good wheat of this variety fit for seed have been stocked in the circle to meet the expected heavy demand. Much of the grain having been damaged on the threshing floors during the last threshing season by untimely rains and wet weather. The private seed centres have also stocked good seed for distribution. The popularity of Pusa 12 is extending and it is probably become the common wheat in districts where conditions are favourable for its cultivation.

Miscellaneous crops.

Seed of maize, ground-nuts, early arhar, oil-seeds, gram, lucerne grass, etc., were distributed from the different farms.

Pumping installations and tube wells.

There being no engine in stock and none coming out from the makers in England on account of the war, the work of the pumping installations could not be extended. Only two Tangyes 7 H.P. engines with the Tangyro centrifugal pumps, obtained from the stock of

the Agricultural Engineer at Cawnpore were installed: one at Kothila, district Aligarh, and the other at Bilram, district Etah, both from *takavi*. Help in the way of repairs and supplying spare parts was freely given to the owners of the old installations in the circle. A pond at Sadarpur in Budaun was tested with a 4½ H.P. engine and 2½" centrifugal pump with a view to installing a bigger pump and engine. The owner of the village, Mr. R. R. Manglani, Barrister-at-Law of Budaun, now intends to get a suitable plant for the pond. He has started cultivation of J33 and other canes in that village and proposes to start a farm on a large scale which will be irrigated from the above-mentioned pond. A power-driving cane-crushing mill will be subsequently added. The plain pipe tube well put down by Rai Bahadur Chaudhri Amar Singh of Pali at Sahanpur and installed with a 10 H.P. Turner oil engine with a 6" × 5" centrifugal pump directly connected to the tube is a great success. A similar plain pipe tube well put down by the department last year at Kunwar Raghubir Singh's garden at Bilram, district Etah, has been installed with a 7 H.P. Tangyes oil engine and a 4" centrifugal pump. This tube well too gives a heavy discharge. The test showed that it could stand a larger pump but unfortunately a bigger engine to drive a bigger pump is not available at present.

The other two similar tube wells in Bulandshahr, one at Lakhaoti owned by Rai Bahadur Chaudhri Amar Singh, and the other at Bondra, are also successful.

A fifth tube has been sunk at village Machua, district Aligarh, by the department, the trial of which has not yet taken place. From experience gained at Bilram, it has been found that a bigger engine is required to drive the pump when it is connected directly with the tube well than in the case when a suction pipe is used in the tube. Bilram tube well will be installed with a bigger plant to make it a demonstration plain pipe tube well for the Aligarh and Etah districts as funds permit. It may be noted that at Bilram only one length of 16 feet pipe of 6" diameter has been sunk down from the highest percolation level which is 16 feet from the ground level.

A borer whose services have been placed at the disposal of Rai Bahadur Chaudhri Amar Singh of Pali has been doing test boring for putting down tube wells under the instructions of Chaudhri Amar Singh in the districts of Bulandshahr and Aligarh. He has been sent recently to Meerut. A test-boring has been done successfully at Kunwar Kalyan Singh's of Barkatpur, district Bulandshahr, and the Pali Engineering Company are making arrangements to supply a suitable plant.

The oil engines supplied by the department have been reported to be doing good work so far.

The cotton gins supplied last year and in the previous years to the selected engine owners for ginning the Buri cotton and making the places as seed centres did not work on account of the poor harvest of Buri during the year under report.

Supply of Agricultural Implements.

Under this head the Meston ploughs, supplied chiefly in the Budaun district, head the list. The rest need no special mention.

Private farms and private seed-supplying centres.

During the year under report two new farms have been laid out, one by Kunwar Madhau Singh of Piwari, district Etah, at his place in Piwari and the other by Thakur Sultan Singh and Niranjan Singh of Mahmudpur at village Mubarakpur, district Etah. The land was already in their *sir* cultivation. It has now been made into regular plots.

The well-managed farm of Mr. F. Welsh at Izatnagar (Bareilly) irrigated from a well by means of a pumping installation supplied by the department, has been further improved and valuable crops of poundas, potatoes, tobacco, ground-nuts, and plantains were raised. Unfortunately some of the poundas were attacked by red rot and the hill potatoes by an insect in the ground.

The farm of Khan Bahadur Muhammad Naim Khan of Kailaspur near Saharanpur and that of Rai Bahadur Chaudhri Amar Singh of Pali were well maintained by the owners without help from the department.

The following recognized private seed centres distributed wheat, cotton and sugarcane seeds:—

(1) Thora, district Bulandshahr, under Lala Ramsurup, president of the Jahangirpur Agricultural Association, distributed wheat and cotton.

(2) Mahmudpur and Kendi under Thakur Niranjan Singh of Mahmudpur in Aligarh distributed chiefly wheat, cotton, and barley.

(3) Hathras under Seth Nathu Lal of Hathras gave Pusa wheat no. 12.

(4) Khunak under Thakur Jagrao Singh of Khunak, district Budaun, distributed Pusa wheat, sugarcane and Meston ploughs.

(5) Machua under Thakur Udhau Singh, distributed wheat and sugarcane.

(6) Chikhal, district Bulandshahr, under Ch. Maharaj Singh and Ch. Lallu Singh issued chiefly Pusa no. 12 wheat and white flowered cotton.

(7) Pali, district Bulandshahr, under Rai Bahadur Chaudhri Amar Singh dealt with wheat Pusa no. 12, white-flowered cotton, saretha, and other varieties of sugarcane.

(8) Birauli, district Bulandshahr, under Pandit Gopal Sarup issued Pusa wheat, cotton and a little indigo seed.

(9) Bhur, district Bulandshahr, under Lala Kirorimal and Thakur Shiva Singh issued Pusa wheat no. 12 and uba sugarcane seed.

(10) Safdalpur, district Bulandshahr, under Thakur Damber Singh issued sugarcane seed.

(11) Ronija, district Bulandshahr, under Lala Sri Gopal grows and supplies all approved seeds.

Khan Bahadur Muhammad Naim Khan of Kailaspur near Saharanpur and a number of other leading zamindars of that district distributed about one thousand maunds of the Pusa wheat no. 12 grown from the seed supplied by the department in the previous year from the Saharanpur Farm and it is believed that about three thousand maunds from the harvest of the year under report is in the stock for distribution. Cultivators of Saharanpur and Bulandshahr have a special liking for this variety of wheat on account of its good yield, size and appearance of grain.

Agricultural Shows.

District exhibitions with agricultural sections were held at Budaun, Aligarh, Bulandshahr, and Meerut. The Muzaffarnagar and Tigri (Moradabad) exhibitions could not be attended this year. From the agricultural point of view the Bulandshahr, Aligarh, and Budaun exhibitions in order of merit showed a decided improvement, a feature being the value of the crops exhibited, specially cotton, wheat, sugarcane, and ground-nuts. The judges found it difficult to select the exhibits for awarding prizes on account of the very uniform excellent quality of wheat, cotton, and ground-nut exhibits. As in previous years the department exhibited its grain exhibits in a specially designed stall separate from the district exhibits and the implements and water lifts in a separate court arranged for the purpose. The fairs were well attended and resulted in the sale of a number of implements.

Steam ploughing.

As it is desired to bring a large tract of the Tarai and Bhabar estates under cultivation the steam tractor plough was sent to that district. The first site selected was unfavourable for ploughing as the high grasses could not be cleared away. The steam tractor plough was specially sent for working deep-rooted weeds, but no tackle was found strong enough to bear the strain and there were frequent breakdowns. In the end of March, therefore, the tractor was taken to another village about three miles from Kichha where conditions were more favourable. The plough works smoothly and 50 acres were ploughed and cross-ploughed without difficulty. As the resident cultivators were unable to bring the larger area under cultivation operations were discontinued. There appears no doubt that a plough of this description will break up large areas of waste-land as soon as the tall grass can be removed by burning or otherwise. This leaves rather a short period for operations but the land after cross-ploughing is left in good condition and could be easily worked for the coming *rabi*.

The use of rosen as a protection for sugarcane seed against whiteants.

The two ends of the sugarcane seed sets are dipped in melted rosen just before planting as a protection against whiteants. The experiment was tried on a large scale at the Nawabganj (Bareilly) Farm. Sealing the ends thus with the rosen not only kept off the whiteants from attacking at and entering through the ends but also protected them from rotting. The treatment has proved efficacious this year and will be tried again next year. The rosen was obtained from the Government Turpentine Distillery, Bhowali, near Naini Tal, at Rs. 13 per maund f. o. r. Bhowali. The method was demonstrated at the various district exhibitions. It was then distributed free to several growers, who took seed of superior varieties of canes also from the departmental farms. The report of the trial has been received from Thakur Jagrao Singh of Khunak, district Budaun, to the effect that the method proved most efficacious on his land where whiteants are a source of trouble. It is most likely to be adopted commonly where whiteants do considerable damage to the seed sets cut from the whole canes for immediate planting. By observation it was noticed that the whiteants not being able to penetrate through the rosen-sealed ends attacked the sets from the nodes near the buds. To protect the nodes and the buds without preventing them from germinating, they were smeared with castor oil which was found keeping off the insects from these points as well. This treatment, with the addition of copper sulphate mixed with the castor oil, will be tried again next year on a large scale.

Sheep-breeding.

A Merino ram was imported in 1912 and kept at Gursikran Usar Reserve with a flock of 30 country ewes. One hundred and ninety-three lambs have been produced, of which 160 were of first generation and 33 in the second. There has been a good deal of disease among the animals to whom the locality appears unsuitable. The wool shows a decided improvement in quality and was sold at a good price.

GANGA PRASAD,
Officiating Deputy Director.

APPENDIX II.

Report on the administration of the Central Circle of the Department of Agriculture, United Provinces, for 1916-17, *by Mr. B. C. Burt, B.Sc., Deputy Director of Agriculture.*

Staff.—I was in charge of the circle throughout the year. In April, 1917, the sanction of the Government was received to the appointment of Pandit Nand Kishore Sharma as Divisional Superintendent of Agriculture for Bundelkhand. It is hoped that this appointment will enable the demonstration work in that important tract, which differs so entirely from the rest of the province, to be more adequately supervised and also considerably extended. For the present the

Divisional Superintendent will deal principally with the Banda and Hamirpur districts. Two students from the Agricultural College who have passed the new vernacular two years' course have been posted to the circle as probationers.

Agricultural stations and demonstrations remain as last year, neither funds nor staff being available for new farms.

District work.

Cotton.—The introduction of Cawnpore American cotton in Cawnpore and parts of the Etawah, Farrukhabad, Mainpuri, and Fatehpur districts along the principal canals has been continued. The season in 1916 was unfavourable for cotton generally. A shortage of canal water in May and early June and the competition of indigo resulted in smaller areas of American cotton being sown and a good deal of unsown seed was returned to the department. The actual area, 1,370 acres, was little larger than in the previous year and as a result of the wettest year on record the out-turn was by no means satisfactory though no worse than *desi* cotton. Two years' experience having shown the absolute necessity of liberal supplies of canal water if American cotton is to be established on any large scale, an attempt has been made to work out, in co-operation with the Irrigation department, a scheme by which the water-supply is concentrated in certain selected channels during the American cotton-sowing period whilst the excluded channels in turn receive special supplies later for country cotton sowings. This scheme is under trial in 1917 for the first time and it is too soon yet to judge of the results, but as far as figures are available there has been a distinct increase in area and far fewer complaints as to the water-supply. In 1916 the American cotton crop was again all taken by the Muir Mills Company, Cawnpore, at a price which enabled the department to pay the minimum premium over *desi* of Re. 1-4-0 per *maund* * of *kapas*. Our original arrangements, made when the prices of cotton were fairly normal and before the sensational rise in the price of all classes of cotton, broke down and I wish to express my appreciation of the way in which the Muir Mills Company met us in the matter. The actual prices received by the cultivators for their American cotton were the highest on record. For the present year the permission of Government has been obtained to the department buying in all the American cotton as *kapas* and placing it on the open market as baled cotton, with the view to establishing its real value and interesting the trade generally. But if long-stapled cotton is to be permanently established an open market for *kapas* where it will be bought on the basis of staple and quality is an essential. The quantity made over to the mills was 113 bales of ginned cotton. The season was a bad one but even so this does not by any means represent the quantity produced. With the rapid rise in prices of *desi* cotton cultivators were anxious to realize their crop as picked and in a number of cases, particularly in out-of-way villages, much of the cotton was sold as *desi*. An attempt is being made to avoid this in the coming season by arranging a number of buying dépôts in various important markets where American cotton as *kapas* will be bought on market days.

Aligarh white-flowered cotton.—The distribution of this cotton in Unao and Hardoi was continued and in 1916 the supply of seed was inadequate to meet the demand. In 1917 14,847 lb. of seed were issued, mostly in the Unao district, in addition to seed stored by the Sandila and Hardoi Co-operative Banks who bought in *kapas* and ginned it for seed. In addition a large area was sown each year from seed kept by cultivators from fields that had been inspected for purity.

K22 cotton.—Extended district trials of this hybrid cotton received from the Economic Botanist were carried out this year. Unfortunately the season was so unfavourable that few results of comparative value could be obtained. The ginned cotton commanded a useful premium in the local market and issues of seed have been made on a larger scale in 1917, the total quantity being 6,480 lb. This has largely been given out in one portion of the Etawah district, where conditions are not suitable for American cotton and where a cotton is required that can be sown, either with the rains or with irrigation. Seed has also been issued in part of one *tahsil* of Cawnpore district and for demonstration and trial in Unao and Hardoi. It is hoped that it will be possible to replace the Aligarh white-flowered variety with its coarse short lint by K22.

K7 cotton.—A limited demand for this cotton, which has a lint distinctly better than *desi*, continues in the Banda and Hamirpur districts and 2,880 lb. of seed have been issued for sowing in 1917. In Jalaun this cotton does not do well, except in dry years, and a selection from the local cotton with a good yield and ginning percentage and valued in Cawnpore as superior to ordinary "Kalpi" cotton is being issued on a small scale this year while a stock of seed is being multiplied.

Wheat.—The systematic introduction of Pusa 12 wheat in the Oudh and *doab* portions of the circle was continued, the total amount issued being 7,400 *maunds* † of which 3,035 *maunds* were produced on our own farms ‡ and 3,547 *maunds* received from Behar through the Imperial Economic Botanist. Of this the largest quantities were distributed in Etawah district (1,625 *maunds*) and in Sitapur (1,402) but considerable quantities also in the Cawnpore, Mainpuri, Hardoi and Unao districts and smaller quantities in Fatehpur. In the Etawah district this wheat is now well established in a number of villages, one village alone (Kudarkot) having about 350 acres. An attempt was made to ascertain through the *kanungos* and *patwaris* the total area in Etawah district sown with this variety, as it was known that much seed had

* 1 maund = 102·9 lb.

† 82·3 lb.

‡ Including 500 *maunds* kindly supplied by the Economic Botanist, United Provinces, from Kalai Farm.

also been kept by cultivators, and that in many cases wheat had been sent to friends in remote parts of the district. No accurate figures were obtained as the work was somewhat perfunctorily done in some cases, but it was ascertained that in those areas in which departmental seed had been issued the area sown with Pusa 12 was approximately double of that for which seed had been issued by us. This wheat is now in general demand in these districts and its general introduction is largely a matter of organizing the seed-supply, a matter of some difficulty in those districts where there are no strong co-operative societies; much however can be done by working only in compact areas. The stock available for issue this year is approximately 10,190 *maunds*, of which 891 *maunds* has been stored by co-operative banks, 1,100 *maunds* by the Sitapur Court of Wards Estate, some 200 *maunds* by the Harchandpur Court of Wards Estate, 157 by a zamindar in Cawnpore from his own farm, and the rest departmentally. Although this is a considerable increase on last year it is only some two-thirds of what was intended, but rain at harvest time materially interfered with the co-operative banks' arrangements for purchasing wheat from members for storage and also deprived the departmental stores of some 3,000 *maunds* of wheat which had been arranged for. Through the kind assistance of the Imperial Economic Botanist 2,220 *maunds* was received from Behar.

In Bundelkhand the issue of Pusa 4 wheat was continued in the canal-irrigated tracts chiefly along the Dhasan, Ken, and Betwa canals in the Hamirpur, Banda, and Jalaun districts respectively. Tentative issues of Pusa 12 were also made in the Rath *tahsil* of Hamirpur on a small scale, whilst in the Jalaun *tahsil* of the Jalaun district the quantity of Pusa 12 and Pusa 4 issued was approximately equal. It seems to be a moot point as to which is the better for the *parwa* tracts but for the *kabar* tracts Pusa 4 alone is supplied. On the Dhasan canal division great assistance was received from the Executive Engineer (Mr. Anderson) and his staff both in distribution and as regards water-supply at the proper time. I also have to acknowledge considerable assistance from Mr. Lane, Executive Engineer, Ken canal, in the same direction. On the Betwa canal a list of villages to which water could be assured was drawn up in consultation with the Executive Engineer and distribution arranged accordingly and in consequence more satisfactory results were obtained than in the past when there were complaints of want of water. Of the Pusa 4 distributed the bulk was received from Behar with the assistance of the Imperial Economic Botanist. The total amount of Pusa 4 wheat distributed was 2,732 *maunds*. Most of this was given out on *sawai* terms. It was found that only a small proportion of the wheat returned at harvest time was fit for re-issue as seed and 2,000 *maunds* were therefore sold to Messrs. Shaw Wallace and Co., Calcutta, (who paid a premium of three annas per maund for it) and replaced by pure seed from Behar. The total quantity of Pusa 4 wheat available for distribution this year is 4,433 *maunds*.

For the unirrigated black soils, Soharia wheat was again issued on a small scale, chiefly around the Orai Farm and near Hamirpur.

Cawnpore 13.—This wheat received from the Economic Botanist, United Provinces, which does well at Cawnpore and at Atarra was issued to the extent of 147 *maunds*, chiefly in the Banda district, for sowing on embanked land and to a smaller extent near Cawnpore where Pusa 12 was apt to be severely damaged by pig. It did uniformly well and will be issued in larger quantities in the same tracts next year. This wheat is of good milling quality and has a good straw.

In order to test the purity of the wheat bought in from cultivators for the 1916 shipping experiment sample lots were sown at the Cawnpore Farm and examined in detail. The results are published in the report on Agricultural Stations in the Central Circle and it is sufficient to say here that the samples of Pusa 12 wheats were commercially pure but that in very few cases were they pure enough for satisfactory seed-supply. This emphasizes the necessity of special precautions for growing wheat which co-operative banks and others propose to buy in for seed-supply and, what is even more important, the necessity for proper arrangements for threshing. The necessity for central seed farms as centres of purity is also apparent.

Sugarcane.—The Java 33 variety was distributed again in Hardoi, Sitapur, and Kheri districts and on a smaller scale elsewhere. From the Agricultural Chemist's farm at Shahjahanpur 300 *maunds** were supplied to the Sitapur Court of Wards and 700 to the Kheri Court of Wards estates At the Hardoi Farm this variety did extremely well and the whole of the farm produce, some 501 *maunds*, were taken up by the local cultivators for sowing; smaller quantities of Reora (282 *maunds*) and Matna (280 *maunds*) varieties were supplied also. Ashy Mauritius grown as a *paunda* cane also did well at Hardoi and 72 *maunds* were supplied for sowing. From the Etawah Farm 149 *maunds* of Java 33 and 776 *maunds* of various varieties of *ukh* were supplied for sowing; 74 *maunds* of Ashy Mauritius for growing as *paunda* were supplied. Sugarcane again did well at Atarra Farm, particularly Java 33 and Hemja; 197 *maunds* were issued for sowing, chiefly on the areas irrigated from the Mahoba and Majgawan lakes. From the Cawnpore Farm 272½ *maunds* of sugarcane for sowing were supplied mostly to neighbouring cultivators and to zamindars in the district, the bulk being Java 33.

Rice.—Demonstrations of transplanted rice on the fields of 57 cultivators, aggregating some 200 acres, were organized from the Atarra Farm. In a number of cases seedlings for transplantation were sold from the farm and the method is becoming established at Baberu in the Banda district; progress would be greater but for shortage of labour. Thirty *maunds* of seed of superior varieties were supplied from Atarra Farm.

Juar.—The three selected varieties referred to in last year's report continued to do well, 118½ *maunds* of seed were issued by the various farms.

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* 1 maund=82·3 lb.

Ground-nuts.—This crop is now established and demands for seed smaller, 64 *maunds* of seed were issued from Cawnpore during the year. There was an increase of some 700 acres in the area in the Unao district, other districts showing no important change. It is believed that the areas reported by *patwaris* are still incomplete.

Indigo.—For the current sowings there was a considerable demand for good seed of the Sumatrana variety and 577 *maunds* of seed from selected cultivators' fields were supplied to zamindars and cultivators. Several zamindars are also growing Java-Natal indigo for seed (for sale to Behar) and some of them have obtained excellent yields. Eighteen *maunds* of Java indigo seed were supplied by the department.

Tobacco.—Seed of Pusa 28 tobacco received from the Imperial Economic Botanist was issued to a number of *kachis* in Fatehgarh and gave satisfactory results.

General.—With some additions to the staff it has been possible to carry out more organized demonstrations of improved agricultural methods, as distinct from the introduction of improved crops or implements.

In Bundelkhand (districts Banda and Hamirpur) green manuring was successfully demonstrated on 20 selected cultivators' fields, the value of hot weather ploughing (on *parwa* soils) on 9, correct methods of sowing crops (sugarcane, ground-nuts, cotton) on 21. Demonstrations of the use of the three-roller sugarcane mill and of *gur*-making were carried out in five villages in the Dhasan canal division.

In the Cawnpore district, where there are now three assistants permanently employed on district work, several trained ploughmen from the Cawnpore Farm have been constantly employed in demonstrating the correct use of iron ploughs and the best methods of sowing crops. With a view to encouraging economy in the use of irrigation water and preventing the losses to the wheat crop which occur from over-irrigation, arrangements were made for the demonstration of lever harrows for breaking the crust on wheat land after the first watering. Demonstrations were carried out in Cawnpore, Etawah, Jalaun, and Banda. In Cawnpore district 127 acres were harrowed and in Etawah 78 acres. These demonstrations will be continued; a cheaper form of harrow is also being tried.

Extremely satisfactory results having been obtained with green manuring for wheat on the light lands in Hardoi, systematic demonstrations have been started there in conjunction with the District Co-operative Bank. In the Cawnpore district our demonstration work has been considerably assisted by the demonstration farm opened by Babu Narain Pershad, a *kurmi* zamindar, in the south of the district. On a farm of some 35 acres a large number of crops recommended by the department have been grown with excellent results and successful demonstrations given of a number of improved methods of cultivation. The farm has attracted great attention amongst the *kurmis* of this part of the district. It is also of interest to note that with the assistance of the Collector, Cawnpore, it has been possible to arrange with the other shareholders in the village for the necessary exchanges of land to create a compact farm in place of a scattered series of fields. One immediate result of the starting of this farm has been a marked demand for the better classes of iron ploughs and other implements, as well as for seed.

Tube well irrigation.—A demonstration tube well was completed by the Agricultural Engineer at Titaura village, district Hardoi, during the last monsoon and was ready for irrigation by the *rabi* season of 1916-17. This was managed departmentally with a view to obtaining definite figures as to costs of working before handing it over to the local co-operative bank for management. The wheat area irrigated was 107 acres and over 30 acres of sugarcane have been successfully irrigated during the present season. The commanded area, forming portion of three villages, is about 400 acres. Considerable trouble was experienced at the start with unlined channels in sandy land and it has been found necessary to spend more money on improving these. This fact and a tendency to over-irrigate, not unnatural in a village which had never possessed any irrigation facilities and where the standard of cultivation was low, makes it difficult to state financial results. But from the figures obtained it can be stated with safety that the rate paid by the cultivators (Rs. 2-3-0 per acre per watering) will cover the working cost, but is insufficient to pay for interest and the amortisation of capital. As it was found that some of the zamindars were materially raising their rents as a result of the irrigation facilities now provided, it is now being arranged that they shall pay a voluntary rate of Rs. 2 per acre commanded to cover interest and depreciation. It is clear that in the case of tube wells installed by zamindars at their own cost the additional rent obtainable is a bigger factor than any profits they may make by selling water.

Potato storage.—Demonstrations were continued of potato storage at Farrukhabad to avoid the losses due to the potato moth. On 141 *maunds* stored in the demonstration store in 1916 a profit of Rs. 321 was realized. In 1917 a similar demonstration has been carried out, the financial results of which will be known in September. The method of storing in sand is now well known in this area and is becoming general, thousands of *maunds* * having been stored in this way in the current year. In certain years a fungus also causes considerable loss in stored potatoes, and potatoes stored in sand suffer more than those stored in open baskets; the loss is in no way comparable with that caused by the potato moth, but experiments are in progress to determine the best way of reducing it. Demonstrations of potato storage in sand have also been started this year in Shahabad, Hardoi. It will probably not be necessary to continue the departmental store at Farrukhabad after this year, but assistance to growers and merchants will continue to be given.

* 1 maund = 82·3 lb.

Agricultural Shows.

District exhibitions with agricultural sections were held at Etawah, Hardoi, Khairabad (Sitapur), and Mainpuri. As last year, the Etawah exhibition was the best and there was again a marked improvement in the quality and number of the agricultural exhibits, particularly of those grown from seed supplied by the department. This exhibition was visited by His Honour the Lieutenant-Governor. The Hardoi exhibition was an improvement on previous years in point of number and quality of exhibits. The combined agricultural and co-operative conference which is always a feature of this exhibition, was attended this year by the Agricultural Adviser to the Government of India. The Mainpuri exhibition was, as usual, organized by the local Agricultural Society and was made the occasion of their general meeting as also of the Co-operative Seed Supply Association. The quality of the exhibits was an improvement on previous years. In Bundelkhand small agricultural shows were held at Chhani (Hamirpur), Chitrakot (Banda) and at Mau Ranipur (district Jhansi), all in connection with local fairs. Exhibits of crops and implements were also sent to fairs at Sheorajpur (Cawnpore) and Rasulpur (Farrukhabad). An Agricultural show was also held for the first time at Sheorajpur in the Fatehpur district which may develop into an important one. Exhibits of crops and implements and an assistant to demonstrate them were sent to all the above shows. At the larger exhibitions exhibits of power-pumping and other power-driven machines were arranged in conjunction with the Agricultural Engineer. Vernacular lectures on agricultural matters were given in all cases and, where possible, lectures illustrated by lantern slides. By invitation an agricultural assistant attended the annual meeting of the *Kurmi Sabha* in the Cawnpore district and gave vernacular lectures on various agricultural improvements; some exhibits were also sent of crops and implements.

Co-operative Societies.

Relations with the stronger co-operative societies have been further developed during the year, chiefly in the matter of seed-supply, and considerable quantities of seed were distributed through the following central and district banks:—Hardoi, Sandila, Unao, Purwa, Padri, Mainpuri, and Jasrana.

In Hardoi both the Hardoi District Bank and the Sandila Central Bank have this year bought in considerable quantities of Pusa 12 wheat seed for storage and re-issue to members this year; their operations have been hampered by unfavourable weather in April and May, which damaged a good deal of wheat on the threshing floors. Agricultural assistants were placed at their disposal to ensure the purity of the seed stored.

The Jasrana Central Bank in district Mainpuri again did good work in seed-distribution buying produce from members for storage and also taking a certain quantity of pure seed from the department. Their financial results have also been satisfactory.

The special society registered for the supply of seed in Mainpuri has now collected a large proportion of its share capital and the seed-store being completed, operations have been started. Here also the unfavourable weather at threshing adversely affected their operations, but it was also unfortunately obvious that some members made no serious effort to fulfil their promises to supply the society with seed. The shortage will be made up this year by sale of seed to the society by the department and it is hoped that more business-like arrangements will be made in future.

A good deal of help in seed-distribution work has been received from the Mainpuri District Bank and it is hoped that close relations will be developed between it and the Seed Supply Society.

The Unao Town Bank and its constituent societies again did important work in seed-distribution. The demand for wheat and cotton seed in this district is keen but unfortunately the Unao Town Bank is saddled with a number of societies whose financial position is by no means satisfactory and there are other difficulties due to faulty organization in the past. Under these circumstances it has not been considered advisable to press this bank to take up further responsibilities and for the present we are utilizing their organisation to develop agricultural work amongst the better societies.

In a number of other matters the various co-operative banks in the circle have given us important assistance and our relations with them have been increasingly intimate. It is hoped that at no distant date the co-operative organization will relieve the department of a good deal of the work connected with the supply of seed and implements.

Seed and Demonstration Farms.

The Kalianpur Seed Farm produced receipts of Rs. 8,568-14-0 as compared to a working expenditure of Rs. 7,649-6-0 in spite of an exceedingly poor cotton crop due to a disastrous season. The seed produced was used in connection with definite schemes for seed introduction and as a consequence it was not in all cases sold to the best advantage. A certain amount of experimental work was also carried out which increased the labour charges. Proposals are now under the consideration of Government for largely increasing the area of this farm.

The Etawah Demonstration Farm has again shown a profit in spite of bad crops of cotton and *juar* consequent on a very wet year.

The Hardoi Demonstration farm is maintained by the district board and that body meets all expenditure and takes all receipts. Allowing for some further capital expenditure, on levelling land and fencing, the farm has shown a profit this year, having had a fine crop of wheat and sugarcane though poor crops of cotton and *juar*.

Private Farms.

Reference has already been made to Babu Narain Pershad's farm at Macha in Cawnpore which, in addition to forming a useful centre for demonstrations, has yielded a handsome profit to the owner. A farm has also been opened at Khurhand in the Banda district by Thakur Har Prashad Singh which is being developed under the guidance of the Divisional Superintendent and which employs a student trained in the Vernacular Course at the Agricultural College as farm manager. In the Allahabad district Rajá Ragho Pershad Narayan Singh of Baraon has also employed a similar past student of the College for the management of his home farm and for agricultural work amongst his tenants. As in previous years a large number of zamindars have materially assisted the department by growing seed and by allowing their *sir* land to be utilized for demonstration purposes. Particular mention may be made of Tewari Ram Ghulam of Kuderkot as largely due to his assistance practically the whole of this large village was this year under Pusa 12 wheat. But for untimely rain in May a valuable supply of pure seed would have been obtained from him. Further assistance was again received from the various zamindars mentioned in last year's report.

Court of Wards Estates.

I am again indebted to the Special Managers in Sitapur and Kheri for much assistance in agricultural matters. The Katesar State in Sitapur, which now owns its own seed store, has this year purchased from tenants and stored some 1,100 *maunds* of Pusa 12 wheat and has in addition distributed considerable quantities of sugarcane and other seeds. As this State now possesses three tube wells the area commanded by these will be used as a nucleus for seed supply schemes and for demonstration purposes.

The Harchandpur Estate in Etawah has during the year cultivated some 40 acres of *sir* land and sanction has now been obtained from the Board of Revenue to work this as a demonstration and seed farm and to lay it out correctly. Considerable quantities of Pusa 12 wheat and of K22 cotton seed have been issued in this estate and sanction to the provision of a seed store has recently been obtained.

In the Rampura State, district Jalaun, which has recently come under the Court of Wards, a home farm of 100 acres has recently been sanctioned and is now being laid out. This, when in working order, will be a most useful centre for demonstration work in this part of the district as well as furnishing an important source of improved seed for tenants of the State. It may be explained that no attempt to carry out anything in the nature of experiments is to be made on either of the above farms which are to be run on business lines. Departmentally trained fieldmen have been supplied for both of these farms.

Experimental work.

As stated last year, a number of definite races of American cotton have been isolated pure from Cawnpore American and several at least superior to the original mixed crop in yield, quality, and ginning percentage. Through the courtesy of the Imperial Cotton Specialist and of Messrs. Tata and Sons, commercial valuations have been obtained of the different types. Their further comparison on a field scale is necessary as the year under report was very abnormal. Some of the more promising are being grown on a larger scale at the seed farm. A pure line has been isolated from the local Jalaun cotton which is well reported on by Cawnpore spinners and which has a high ginning percentage and is a good yielder. This is being multiplied for issue. Further interesting results have been obtained in connection with *do-fasli* cropping. The detailed results are published in the *Agricultural Journal of India* and in the farm report. It is sufficient to say here that in the most important case wheat after maize, use of nitrates is not likely to be profitable as first appeared but that adequate cultivation of the land between the two crops and fair manuring of the *kharif* crop are all that is necessary. It has again been possible to grow good crops of wheat (particularly of early varieties such as Pusa 4) after fodder *juar*. Cawnpore 13 wheat has done well at both Cawnpore and Atarra and is being distributed for embanked land in Banda and also in certain villages in Cawnpore where it has done well. Excellent results were obtained with green manuring at Hardoi Farm; at Cawnpore green manuring, combined with superphosphate, did better than green manuring alone. A new method of green manuring suggested by the Imperial Agricultural Bacteriologist did not do so well at Cawnpore as the ordinary method. Pusa 28 tobacco at both Cawnpore and Atarra has again done better than local varieties. *Mahua* cake as a manure for sugarcane and similar crops has again given satisfactory results.

Some examinations of the root systems of *desi* and American cottons made at Cawnpore last year, combined with the results obtained from sowings on different dates, would appear to indicate that the length of the flowering period is not the only factor and that early sowing with irrigation is necessary to establish a satisfactory root system.

Various experiments with wheat, cotton, gram, *arhar*, *juar*, sugarcane, *flax and tobacco* were continued at the various farms. The results are detailed in the report on experiment stations.

Seed supply.—The progress made in the issue of seed of the more important crops has been stated in the body of the report. The following figures for seed issued from the various seed stores and farms cover the administrative year which does not coincide with the seasonal issues.

The central seed-store at Cawnpore issued 8,263 *maunds* of seed of 48 kinds (excluding sugarcane sets); the Atarra Farm supplied 2,436 *maunds* of seed of 24 kinds, the Etawah Farm supplied 2,658 *maunds* of seed of 16 kinds; the Orai Farm 1,303 *maunds* of 5 kinds; the

Hardoi Farm 1,480 *maunds* of seed (apart from direct supplies to the co-operative banks); the Madhogarh sub-station, (Jalaun) distributed 797 *maunds* of seed and from the Mainpuri Farm about 700 *maunds* of seed were distributed.

Implements.

From Cawnpore 598 implements were supplied during the year, of which 452 were ploughs, the other important items being 25 chain pumps, 23 chaff-cutters, 14 three-roller sugarcane mills, and 10 lever harrows. Some difficulty was experienced in getting implements and prices have gone up very considerably. The main demand is still for small iron ploughs of the Meston pattern, but there is a marked tendency, in Cawnpore district particularly, towards the use of larger and better ploughs also. Stocks of implements were maintained at the various farms also for supply to cultivators and also small stocks were placed with selected zamindars for sale or hire. The hiring of implements to cultivators has been largely discontinued except in new areas for demonstration purposes as the losses were disproportionate. A number of cultivators have in consequence bought implements on instalments.

Publications.

An article on manuring in connection with *do-fasli* cropping has been contributed to the *Agricultural Journal of India* A new pamphlet on manures is now in the press and another on agricultural implements (illustrated) will be published as soon as sanction to the special arrangements necessary for the illustrations is received. These pamphlets are published in Urdu and Hindi with a limited edition in English and are distributed free on application. There is a large demand for many of them, particularly for the pamphlet on ploughs and ploughing and on crops recommended for the Central Circle.

Correspondence again increased during the year, the number of letters received being 5,238 and of issues 6,657. Agricultural enquiries, apart from the large number dealt with direct by the touring staff, numbered 840.

B. C. BURT,

Deputy Director of Agriculture,
Central Circle.

Dated the 29th July, 1917.

APPENDIX III.

Note on the administration of the Eastern Circle, United Provinces, by Mr. L. C. Sharma, Assistant Director of Agriculture.

The work of the Eastern Circle done during the year under report may be classified as follows:—

I.—Experimental Investigations.
II.—Demonstration Work.
III.—Private Farms and their organization.
IV.—Seed Dépôts and their organization.
V.—Miscellaneous work.

I.—Experimental Investigations.

These were carried out chiefly at the Partabgarh and the Benares Agricultural Stations and the details of the work, together with results obtained, are given on the respective reports of the said stations for the year 1916-17.

It will not, however, be out of place to briefly mention here some of the most important results of some of the investigations.

(a) Varietal experiments.—The results of the varietal experiments conducted during the year corroborate with those of the last four years and prove that Pusa 12 wheat, Improved Barley, Long Marrow Fat Peas, Large Japanese Ground-nuts, Bansphul Paddy, Jaunpur Maize, are best suited for the locality.

Among the sugarcane varieties Barbadoes, 208 gave the highest outturn of 13,242 lbs. of *gur* per acre.

Pusa 12 variety, which was also tried on low-lying (Tarai) land without any irrigation and manuring, yielded 2,152 lbs. of very good grain per acre.

(b) Manurial experiments.—Hansraj variety treated with neem cake at the rate of 600 lbs. per acre gave an outturn of 1,880 lbs. rice per acre, i.e. more than 50 per cent. higher as compared with that of the application of other manures.

Mahua cake to wheat crop at the rate of 1,640 lbs. per acre will also increase the outturn provided the fields are well irrigated.

(c) Do-fasli rotation, i.e. two crops in rotation in the same year.—The results of this experiment show that the most profitable rotation are *juar* and *mung* followed by white peas and wheat after maize with suitable cultivation.

(d) Reclamation of ravine land.—The undue erosion caused by heavy rains on the ravine land can be considerably checked by making drains in suitable places so as to decrease the force with which the water flows on the surface of the ravine and getting the suspended silt deposited in the lower portion of the fields by making small embankments. The texture of the soil is improved by green manuring or application of the farm-yard manure. The silt deposited in the

Chilbila Ravine Farms in the Partabgarh district during the last eight years measures 11″ to 26″ and we are now able to grow fairly good crops on the land.

The experience of the past few years show that mango and *mahua* trees can thrive best on such a land.

(e) Reclamation of usar land.—By washing off the injurious salts, deep ploughing, drains and necessary bunds and growing deep-rooted crops such as *arhar*, Dhaincha, Sann (hemp), Indigo; etc., has met with a considerable success. With a view to conduct the usar experiment on a much larger scale an area of about 100 acres of a typical usar land was taken from the Raja of Amethi for six years free of rent on condition that it would be returned to him without claiming any compensation for the improvement of the land.

II.—Demonstration Farms.

The object of these is to bring to notice of zamindars and cultivators some of the definite results obtained at the Government agricultural Stations of this circle. This object was served by (1) district demonstration Farm and (2) a large number of demonstrations given in cultivators' fields on as large a scale as possible.

(1) There are now eleven demonstration farms in this circle, viz. those at Sultanpur, Rae Bareli, Ballia, Bara Banki, Ajudhia, Ghazipur, Lucknow, Bikapur, Muswapur, and Kalli Pacham.

(2) Demonstrations.

A large number of demonstrations was given in every district, in some cases the demonstrations were given on 41 to 50 acres scale, while in four villages the whole of the wheat-growing area was put under Pusa 12.

III.—Private Farms and their organization.

There are now 44 private farms in this circle (not including those that are less than 20 acres in area).

They were primarily started with the following objects in view:—

(a) To familiarize the cultivators with the growing of more profitable crops and the improved methods of cultivation.

(b) To grow improved seed on large scales.

(c) For farming as a profitable concern.

2. Among *rabi* crops wheat being one of the most paying crops in the locality and the one most in demand, Pusa 12 variety, which had conclusively proved on Government farms as the one most suitable, was recommended for trial on private farms. Its outturns have so far been highly satisfactory.

Among *kharif* crops Bansmati and Hansraj varieties of paddy and some varieties of thick sugarcanes have also proved profitable.

3. The private farms although originally started on a small scale, have within the last three years grown into large farms. A good many of them are over 100 acres while a few over 200.

4. Recently they have been considerably enlarged, while a good deal has been done towards their improvement. The following is a description of those from which accounts of working have been submitted.

(1) *Kurri Sudauli Farm.*—This belongs to the Hon'ble Sir Raja Rampal Singh, K.C.I.E., of Kurri Sudauli in the Rae Bareli district and is 60·6 acres in area.

The chief crops grown were Pusa 12 wheat, a few selected varieties of rice and sugarcanes. The results of Pusa 12 wheat and Saretha variety of sugarcanes were highly satisfactory.

The farm made a net profit of Rs. 923 as will appear from the statement given below. Pusa 12 wheat gave 12 maunds of good grain per bigha as compared with 7 maunds of the local variety and resulted in a large saving of grain in the seed rate for sowing:—

Statement showing the financial position of Kurri Sudauli Farm, district Rae Bareli, for 1916-17.

Name of the farm.	Area in acres.	Expenditure.	Receipt.	Profit.	Remarks.
		Rs. a. p.	Rs. a. p	Rs, a. p.	
Kurri Sudauli Farm ..	60·6	867 10 0	1,790 10 9	923 0 9	

(2). *Gaura Farm.*—This belongs to the Thakurain of Gaura and it is supervised by the Hon'ble Sir Raja Rampal Singh, K.C.I.E., of Kurri Sudauli. The area for the present is 30 acres and the results obtained were so promising that it is being extended to 50 acres. The whole outturn of Pusa no. 12 wheat produced on the farm has been kept for distribution among the cultivators of the estate.

(3) *Chandapur Farm.*—It belongs to the Hon'ble Raja Chandrachur Singh of Chandapur in the Rae Bareli district. It is situated in Chandapur about 17 miles from Rae Bareli. The area of the farm is 75·8 acres. Pusa 12 wheat has been well established in the locality and is getting popular with the cultivators of the neighbourhood.

The farm is managed by a competent man under the direct supervision of the Raja. The chief crops grown at this farm were sugarcane, wheat, maize and dhan. It gave a net profit of Rs. 2,084-8-9. The following statement gives the necessary details :—

Statement showing the receipt and expenditure, etc., of the Chandapur Farm, district Rae Bareli, for 1916-17.

Name of the farm.	Area in acres.	Expenditure.	Receipt.	Profit.	Remarks.
		Rs. a. p.	Rs. a. p.	Rs. a. p.	
Chandapur Agricultural Farm	75·8	1,913 11 0	3,908 3 9	2,084 8 9	Pusa 12 wheat gave about half of the total income.

(4) *Rahwan Farm.*—This belongs to Thakur Jagannath Bukhsh Singh, a taluqdar of Rahwan estate in the Rae Bareli district. It is situated three miles south of the Harchandpur railway station.

The Pusa 12 wheat crops gave highly satisfactory results and the farm made a net profit of Rs. 1,191-6-9 as is clear from the following statement :—

Statement showing the financial position of the Rahwan Estate farm, district Rae Bareli, for 1916-17.

Name of the farm.	Area in acres.	Expenditure.	Receipt.	Profit.	Remarks.
		Rs. a. p.	Rs. a. p.	Rs. a. p.	
Rahwan Farm	50	587 8 0	1,778 14 9	1,191 6 9	

(5) *Brahmani Farm.*—This has been extended from 40 to 100 acres in area and belongs to Tiloi estate in the Rae Bareli district, and is worked under the supervision of Mr. H. C. Young, Special Manager, Court of Wards, who is keenly interested in agriculture and working in consultation with the Agricultural department.

(6) *Fort Partabgarh Farm.*—It belongs to Raja Partab Bahadur Singh, C.I.E., of Fort Partabgarh and is situated close to his palace on the Katra tank road. Originally its area was 30 acres, but is now being considerably extended. Pusa 12 wheat and other profitable crops were grown at this farm after the improved methods of cultivation. The farm is introducing improved seeds among the cultivators of the neighbourhood and doing a useful work in familiarizing the zamindars and cultivators with improved crops. It gave a net profit of Rs. 2,175 during the year under report. The farm was started in 1913.

(7) *Isanpur Farm.*—It belongs to the taluqdar of Isanpur and is 50 acres in area and situated at Isanpur. Under the directions of the Assistant Director, Pusa 12 wheat, Bansmati, Dadkhani varieties of paddy, Jaunpur maize, selected varieties of sugarcanes thick, cotton, and ground-nut were grown on the farm and all of them gave highly satisfactory results.

(8) *Model Farm.*—This belongs to Babu Mata Pershad, *Rais* and Honorary Magistrate, Benares, and also Honorary Visitor of the Benares Agricultural Station. It is managed by the owner under the instructions of the Agricultural department. The object is to introduce Pusa 12 wheat, ground-nuts, selected varieties of cane among his cultivators.

The efforts of the owner have met with a reasonable success.

(9) *Lucknow Demonstration Farms.*—Two farms more were added during the year under report to those six opened last year and although they are yet in their infancy from the amount of interest taken in agriculture by the respective owners they should prove successful. The two largest are owned by the taluqdars of Itaunja and Malihabad.

(10) *Sasendi Farms (Lucknow).*—These two farms were started by the Court of Wards in Mohanlalganj *tahsil* in co-operation with the tenants of the Sasendi estate in the villages of Dewa and Mau on areas of 22 and 23 acres respectively. Pusa 12 wheat was grown over the entire area. The tenants were pleased with the crop and a larger area will be put under Pusa 12 wheat next season. A good demand for seed has been created in the neighbourhood.

(11) *Naugawan Seed Farm.*—It is about 400 acres in area and situated on Lucknow-Sultanpur road, 7 miles from Amethi railway station. The land was taken on rent from the Raja of Amethi and the farm is worked by the Assistant Director in co-operation with him. The main object of the farm is the multiplication of improved seeds and to obtain a pure stock of improved seeds for distribution among the tenants of the locality.

(12) *Amethi Farms.*—They are three in number and belong to the Raja Sahib of Amethi. I have not as yet received the report of these farms, but I know that they are making a satisfactory progress. These farms supplied 1,000 maunds Pusa 12 wheat to the North-Eastern circle and 300 maunds to the Central Circle.

(13) *Kurwar Co-operative Farm.*—It is situated close to the river Gomti, about a mile from the Raja's palace. At the request of the co-operative society the Agricultural Engineer has put up a pumping plant for irrigating the farm area from the river.

(14) *Marna Farm.*—It has been started by Rai Shiva Pershad Bahadur, Junior Secretary, Board of Revenue, and is situated on the Fyzabad-Jaunpur road, 12 miles from Fyzabad. It consists of Manjha land and is about 700 acres in area, but with the exception of 100 acres

the rest is worked in co-operation with the tenants. The crop of sugarcane is in a flourishing condition and a large area is reserved for growing Pusa 12 wheat next season.

The establishment of these farms clearly shows the interest now being taken by taluqdars and large zamindars in agriculture. With land and capital at their command they are capable of taking the lead in improvements and in course of time affecting the whole system of agriculture in the province. Further each of these private farms has brought the department and the taluqdars concerned in close touch with one another and created a spirit of co-operation and friendly rivalry between them. They have enabled the landlords to appreciate the nature of the work of the officers of the department and will help them to work together for the common object both have in view.

IV.—Seed Depôts and their organization.

There are now 15 Government and 4 district board seed dépôts in this circle that issue improved seeds.

The latter are financed by the district boards of Fyzabad and Sultanpur but managed by the Assistant Director on the lines of the Government Seed Dépôts. Besides there are private seed dépôts attached to the private farms and financed and managed by the respective owners thereof.

During the year under report 24,045 maunds 12 seers 11 chattaks improved seeds of all kinds (viz., 2,891 maunds 18 seers 1 chattak *kharif* and 21,153 maunds 34 seers 10 chattaks *rabi*) were distributed from the Government and the district board seed dépôts alone.

Besides improved seeds worth Rs. 7,204-5-6 were sold away on cash price to various indentors and private farms.

Arrangements have been made to renew one-fourth of the seed stock every year so as to keep it pure.

The chief advantages of our improved seeds are—

(a) a saving of 30—60 lbs. of grain in the seed rate for sowing per acre,

(b) higher outturns of superior quality.

The demand for improved seeds is increasing and the Government was pleased to sanction Rs. 55,000 (30,000 + 25,000) as an advance during the year under report with a view to meet it.

Besides this, the Government also sanctioned Rs. 10,000 as an advance for six months to provide *rabi* seeds for the cultivators of the flooded area of the Ballia and Mirzapur districts.

This amount has since been recovered and refunded.

V.—Miscellaneous.

(a) Boring work.—The boring work at the Naugawan-Muswapur Farms has proved successful, also that of Basaha Farm. Besides there are other wells which have been bored during the year under report by the *muharrirs* placed under me. A few of these have been tested with 1¼" ram pump and all except two are reported to be successful, although it remains still to be seen whether they will give sufficient water for a centrifugal pump. There is, of course, no doubt that they will gradually improve by pumping.

The success of the boring work done at the farms has much attracted the public attention and created demand for pumping plants. It is unfortunate that pumping plants are not available owing to the war.

(b) Phangi.—On receipt of a report from the Manager, Dumraon Raj, through the Collector of Ballia regarding attack of phangi to the sugarcane crops, the Agricultural department rendered considerable assistance in combating the pest. Two Agricultural overseers and three fieldmen were deputed to overcome the pest by means of bagging and burning of lamps on the borders of the fields. These processes proved very effective. But a good deal of damage to the crops had already been done. Then in consultation with the Imperial Entomologist deep ploughings by the Meston plough of the sugarcane fields from where the affected crop was harvested was adopted in 50 villages with a view to destroy the eggs and larvæ of the grasshoppers by exposing them to the sun. The use of the Meston plough has been highly appreciated by the zamindars and cultivators in this connection.

(c) Agricultural exhibitions.—Eight agricultural shows and exhibitions were held in the districts of Benares, Ghazipur, Ballia, Rae Bareli, Bara Banki, and Lucknow in the year under report.

Agricultural machines and samples of improved seeds were exhibited in all of them and the use of the improved agricultural implements demonstrated. Lectures were given on agricultural subjects as usual which were much appreciated by the agricultural public.

(d) Agricultural implements.—Besides 138 spare parts eight machines and 132 implements were sold during the year under report, the details of which are given in the report of the Partabgarh Farm.

(e) Monthly Agricultural Journals.—The vernacular agricultural journals *Mufid-ul Mazurain* (Urdu) and *Kisan up Karak* (Hindi) have been issued regularly throughout the year. There were on the whole 88 articles issued in the journals. There were some illustrated articles which were much appreciated by the agriculturists and were reproduced by *Dehati*, an agricultural journal published in Nagri character, and a few other papers. The journals are becoming more popular every month. Every effort is made to make the journals as interesting and useful as possible. The total circulation of both the Urdu and Hindi journals was in the last year 1,063.

(f) Correspondence.—The total number of letters received and issued during the year under report were 3,403 and 4,168, respectively, against 3,069 and 2,938 in the previous year, excluding demi-official correspondence.

PARTABGARH: L. C. SHARMA, M.R.A.C., P.A.S.I.,

Dated the 23rd August, 1917. *Barrister-at-Law,*

Assistant Director of Agriculture.

APPENDIX IV.

Report on the administration of the Agricultural College, Cawnpore, for 1916-17, *by Mr. H. M. Leake, M. A. (Cantab.), F.L.S., Principal.*

As during the previous year, the post of Principal has been held by me throughout the year as additional to my duties as Economic Botanist to Government, United Provinces. The staff, as was pointed out in last year's report, was at that time seriously deficient. The deficiency still remains to some extent in the gazetted staff as an Agriculturist is still to be appointed and Mr. Wilson's post also remains vacant. With regard to the former a certain amount of relief has been afforded, since during the last months of the year supervision of the Agricultural courses has been undertaken by Mr. Annett, on deputation from Bengal in connection with opium work; while the service of Mr. Youngman for two days a week, to a certain extent replaced the loss of Mr. Wilson. Throughout the year the post of Warden has been held by Mr. Holt. By the provision of two new posts the lecturing staff has now been increased sufficiently to cope with the increased activity of the College in which six classes have replaced the three held under the old system.

The four-years course.—Admissions to this course were made in July, 1916, when 23 students were selected out of the 45 applying for admission.

This is the third year of admission under the scheme of re-organization and the successive figures are—

Year.	Applications received.	Admitted.	State students	Revenue paid by United Provinces students.
				Rs.
1914	14	10	1	593
1915	27	11	1	35,214
1916	45	23	6	2,02,361

The first qualifying examination was held in April last. This examination, which takes place at the end of the third year, forms the qualification for the diploma, students who pass it specializing in the fourth year for the final examination for the diploma. Of the work of the students the examiner in Agriculture writes:—

"The examiner was favourably impressed with the candidates; they seem to be much more practical than the usual type of Indian Agricultural students."

The Chemistry results were not so satisfactory and the Governing Body decided that the course should be repeated in the fourth year and students re-examined.

One student, L. Gardner, of the second-year class, has left the College to enlist in the Anglo-Indian Force.

Two-years course.—Students forming the third year of admission to this course joined the College in July, 1916, when of 146 applicants 25 were admitted. The successive figures for admission to this course are as follows:—

Year.	Applications received.	Admitted.	State students.	Revenue paid by United Provinces students.
				Rs.
1914	144	21	..	11,354
1915	104	21	3	32,036
1916	146	25	2	1,21,587

Again, the figures show a very satisfactory progressive increase indicating the popularity of this course among the agricultural community.

The first year to pass out from this course left the College in September, 1916.

It may be noted that a large proportion of the students admitted to this course were selected for admission to the old three-years course and on the re-organization in 1914 offered the alternative of the two or four-years courses. There is not, therefore, in this class the large

proportion of the zamindari class, as compared with the 1915 and 1916 admissions, who have joined the college with the object of returning to their own lands after leaving. Of 18 students who have left in September, 1916, the following table indicates the number of employments :—

(1)	Taken into Subordinate Agricultural Service	5
(2)	Do. by the Department of Agriculture, United Provinces	2
(3)	Do. by the Co-operative Department	5
(4)	Do. by the district board—	1
(5)	Do. by a Native State	1
(6)	Do. by a private estate	1

For various reasons it has not been possible to procure external examiners for the final two-years course, though, when times become less strenuous, this will be done. It is not possible, therefore, to quote any examination report to indicate the value of the instruction given in this course. The following remark, which occurs in correspondence received from a District Officer with reference to one student, may afford some indication of what is being accomplished :—

"I am very pleased. He has improved beyond recognition."

Before this appears in print the second batch of students of the two years' course will have left the College and before the next Annual Report appears, the first of the four years course will also have left. While the number of students who are returning to their own estates is progressively increasing, there will be a certain number of students anxious to obtain employment. To find such employment it is proposed to start an "Employment Bureau" and it is hoped that zamindars desirous of procuring managers for their estates will apply to the College. For a short time to come the number of candidates for such posts will be small and it is impossible to make supply and demand coincide exactly under such circumstances. It is, however, very desirable to create a demand, if the College is to be of the fullest use, and with the elasticity given by increased numbers the difficulties in equalizing the two factors will pass.

Last year's report recorded the rebuilding of the farm buildings; this year attention has been devoted to the dairy which has been re-stocked with a herd of Montgomery cows and Murrah buffaloes specially selected by the Civil Veterinary departments of these provinces and the Punjab. The herd is doing well and my thanks are due to the officers of these departments for their kindness and for the trouble taken by them.

APPENDIX V.

Report on the administration of the Botanical section for 1916-17, *by Mr. H. M. Leake, M.A., (Cantab.), F.L.S., Economic Botanist to Government, United Provinces.*

Charge.—I held charge of the post of the Economic Botanist to Government, United Provinces, throughout the year, the post of the Assistant Economic Botanist vacated by Mr. Wilson during the previous year remaining vacant. Mr. Youngman has, by the courtesy of the authorities of the Canning College, Lucknow, been able to visit Cawnpore twice a week to take charge of the Botanical work of the College.

Research.—As during last year, I have throughout the year been in charge of the College and for a considerable portion of the year responsible also for supervision of the Agricultural teaching. The amount of research work has been consequently limited and I have been unable to prepare any material for publication.

Major Researches.

1. *Cotton.*—Work on this crop has again been practically limited to preventing loss of material and to the extension of the type K. no. 22. Of the two types mentioned last year, K. no. 7 and K. no. 22, the latter is undoubtedly superior and the former type is being dropped. Particulars of the results achieved with the latter await a more favourable opportunity for publication but I may note that the cotton problem of the United Provinces, as it appears to me, may be briefly summed up as the production of a high ginning and high yielding race of cotton with a lint quality which could normally find a market in India but which, in times of shortage would find a market in Lancashire. How far K. no. 22 satisfies this definition is shown by the following. I have now a considerable acreage under races ginning 40 per cent.; though perhaps not so resistant to moist conditions, in a good cotton year it yields as much *kapas* as the Aligarh white-flowered; while as regards lint, the following remark from a broker at home will show how far it fulfils the requirements given above :—

"The sample of cotton you sent is certainly usable by a considerable number of Lancashire spinners provided they could not get anything better, they being very conservative. I fully agree with you that after the war we shall be very short of cotton with a big demand, in fact we are fast reaching a famine in Liverpool with cotton 1*s.* 5*d.* per lb."

I may refer here to the extension of cultivation of the plant into Central India. Trials made last year were sufficiently promising to justify Mr. Coventry distributing all the seed I could provide. That quality of the lint vastly improves under Malwa conditions is shown by the fact that samples are valued as nearly equal to best Ujjain.

2. *Opium.*—The amount of work devoted to this subject has been considerable and the results obtained have exceeded expectation. They have formed the subject of separate notes to Government and it is not possible to refer to them here. I may, however, say that the progress has only been rendered possible by the deputation of Mr. Annett to study the problem in its chemical aspect.

Minor Researches.

1. *Wheat.*—Work on this subject remains limited to the multiplication of the kind known as Cawnpore no. 13.

2. *Barley.*—Work limited to preventing loss of material.

Seed farm.—The farm has been in charge of Babu Ram Prasad throughout the year. The season was a most unfavourable one for cotton as, owing to the excessive rain, a considerable portion of the crop was standing for days in a foot of water. Arrangements have now been made with the Canal department to secure adequate drainage in future. The cotton crop, which consisted of K. no. 22 was poor. On the other hand the wheat crop, partly Pusa 12 and partly Cawnpore no. 13 was good. Seed of K. no. 22 cotton has been distributed to the Deputy Director of Agriculture, Central Circle, and to the Agricultural Adviser, Central India. The whole farm is now under a race of K. no. 22 ginning 36 per cent. as opposed to the average 33 per cent. of last year. The expenditure on the farm amounted to Rs. 10,398-1-8, of which Rs. 2,397 was incurred on non-recurrent (capital) charges. Total income, including Rs. 2,997 for produce, calculated at realized rates, distributed free to the department, amounted to Rs. 10,780-11-6, leaving a profit on the year's working of Rs. 3,379-9-10.

H. M. LEAKE,

Economic Botanist to Government, United Provinces.

APPENDIX VI.

Report on the administration of the Chemical section for 1916-17.

During the whole year under report G. Clarke, Esq., F.I.C., F.C.S., was on leave.

The practical and theoretical teaching of Chemistry and Physics was carried out on the lines laid down in the past years and no new developments were introduced into the courses.

The results of the Chemistry examination of third-year students were very unsatisfactory. As a result of this, a supplementary class for the students was opened in their fourth year to revise their chemistry courses.

The courses as were prescribed for the vernacular classes in Chemistry and Physics were disapproved and a new syllabus was drawn up and introduced.

In the teaching staff there was no change excepting the appointment, on one year's probation, of Lala Ram Saran Das, M.Sc., as second Demonstrator in the place vacated last year by the transfer of Babu Brij Lal Mathur, B.Sc.

The research farm at Shahjahanpur was under the management of Munshi Naib Husain, Superintendent, during Mr. Clarke's absence. The work was carried out on the lines laid down by that officer. Five thousand one hundred and seven maunds of cane seed were distributed, of which 4,140 consisted of Java 33. There was a strong demand for all classes of seed and the whole of that available in that farm was disposed of. The farm had a very fine crop of Pusa 12 wheat, the average being 35 maunds per acre on 18 acres.

The receipts of the farm amounted to Rs. 9,662 and expenditure to Rs. 7,500.

APPENDIX VII.

Report on the administration of Agricultural Engineering for 1916-17 *by Mr. F. H. Vick, M.I.M.E., Agricultural Engineer.*

General remarks.—The difficulty in obtaining all ironwork supplies from England which I mentioned in last year's report has not only continued throughout the year under review but has become much more acute and it is now almost impossible to secure the necessary plant to carry on work except on a very limited scale. There is a very keen demand at present in the province for Tube-wells, engines, pumps, and other machinery—a demand which I have therefore under existing conditions of scarcity been unable to satisfy. It is hoped that by putting indents through the Munitions Boards, which has been lately established in India, the necessary plant, for carrying on work in the immediate future, will be forthcoming.

Power-boring.—The Australian power-boring Plant has done very useful work and has fully justified its purchase. In one case, a 15″ diameter boring 210 feet deep through clays, sands, and kankars was done with 12 days' boring which shows very great advance on hand-boring methods doing an average of about 3 feet a day. Three more Machine-borers of similar make have been ordered and I hope to have them at work in the coming cold weather.

Tube wells.—Successful Tube-wells have been sunk and started to work in many districts as under :—

Hardoi	2
Gorakhpur	2
Fatehgarh	1
Etah	1
Moradabad	1
Sitapur	2
Saharanpur	3
Gonda	2
Budaun	1
Total ...	15

Many more Tube-wells would have been made but for the delays occasioned through lack of plant and material.

The capacity of some of the later Tube-wells has exceeded 40,000 gallons per hour constant yield, and there is no doubt that this form of Well will be used largely in future in the province and that big areas will be irrigated from them.

Pumping machinery.—A number of installations have been arranged during the year to pump from ordinary wells, jheels, etc. One in particular working very satisfactorily on a jheel in Etah district, lifts 120,000 gallons per hour and irrigates about 20 acres a day with immense benefit to a big area of land previously almost barren through lack of irrigation facilities.

A pump and engine also has been installed at Muttra Cattle Farm to irrigate the cultivated area and is running with success.

Engine-drivers.—Formerly a difficulty was found in providing drivers for the Engines installed, but this has now been got over by running training classes at the Cawnpore workshops. It is found that with two or three months' training a man is quite capable of taking over and running an engine of small or medium power.

Students' classes.—The classes in Mechanical Engineering have been run as usual, throughout the year, for the College students. They are taught to work practically on all ordinary workshop operations and many of them become quite useful Mechanics. They are instructed also in oil engine-driving and the fixing and running of other machinery likely to be used in farm operations. They get too a course of lectures in the theory of elementary Applied Mechanics.

Advisory work.—Advice has been given as usual to all applicants requiring help in Well construction and installation of machinery Practical assistance has also been given, when required, by lending a Borer or Mechanic.

F. H. VICK,

Agricultural Engineer, United Provinces.

APPENDIX VIII.

Note on arboricultural operations during 1916-17.

The working-plans provided for tree planting on 52 miles of provincial and 178 miles of local roads. The lengths actually planted totalled 49 miles and 211 miles respectively. Trees were planted along 46 miles of local roads, mainly in Gonda, Bahraich, and Fyzabad, by private individuals.

Working-plan.—The majority of the districts carried out their working-plans but there was divergence from the plans in seven districts on provincial and eight districts on local roads. The most common cause of divergence on local roads was the curtailment of new planting in favour of gap-filling but in several districts the cause was less legitimate, revealing defects in or want of attention to the working-plans. Thus in one district the failure to plant trees was due to lack of good seedlings and *thalas* and in another to maintenance of young avenues for one year more. In two districts funds were diverted either to planting some miles in advance or to nursing the young trees so planted last year. The planting of unsuitable trees has almost ceased in the provinces, the only case of importance being plantation of a number of *sirris* trees in Etawah.

Extension of avenues.—Few cases of "paper avenues" have come to light during the year. For the province, as a whole, 16 miles misclassified as avenues have disappeared from the list, while 246 miles of recent plantings have been added as "established avenues."

Training of supervisors.—The number of trained candidates on the list still exceeds the needs of the district boards of these provinces. No training class was therefore held during the year.

Financial results.—The receipts on provincial roads rose from Rs. 33,970 to Rs. 39,098 and the expenditure fell from Rs. 73,371 to Rs. 73,076. The net cost to Government was thus Rs. 33,978 as compared with Rs. 39,401 in the last year. The receipts from local roads were Rs. 79,815 or Rs. 15,097 more than those of the preceding year, while the expenditure fell from Rs. 1,23,396 to Rs. 1,21,118.

REPORT

ON THE

ADMINISTRATION OF THE DEPARTMENT OF AGRICULTURE

OF THE

UNITED PROVINCES OF AGRA AND OUDH.

FOR THE YEAR ENDING 30TH JUNE, 1919.

ALLAHABAD:

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Glossary of crops mentioned in the report.

English or Vernacular names of the crops.	Botanical names equivalent to the English or Vernacular names.
1. Gram	Cicer arietinum.
2. Bajra	Pennisetum Typhoideum.
3. Paddy	Oryza Sativa.
4. Juar	Sorghum Vulgare.
5. Groundnuts	Arachis hypogæa.
6. Sann-hemp	Crotolaria Juncea.
7. Arhar	Cajanus indicus.
8. Bhusa	Straw (English).
9. Kharif	Autumn harvest.
10. Rabi	Spring harvest.
11. One seer=2 lb.	
12. One maund=82 $\frac{2}{7}$ lb.	
13. Kapas	Gossypium Neglectum.
14. Uk	Saccharum Officinarum.
15. Reora	A kind of sugarcane.
16. Paunda	,, ,, ,,
17. Hemja	,, ,, ,,
18. Dikchan	,, ,, ,,
19. Khandsaris	Professional sugar-boilers.

Report on the administration of the Department of Agriculture, United Provinces, for the year ending 30th June, 1919.

No. $\frac{26}{V-359B}$

FROM

THE HON'BLE MR. H. R. C. HAILEY, C.I.E., I.C.S.,

DIRECTOR OF LAND RECORDS AND AGRICULTURE,

UNITED PROVINCES,

TO

THE CHIEF SECRETARY TO GOVERNMENT,

UNITED PROVINCES, REVENUE DEPARTMENT.

Dated Lucknow, the 10th of October, 1919.

SIR,

I HAVE the honour to submit the report on the administration of the department of Agriculture, United Provinces, for the year ending 30th June, 1919.

CHAPTER I.

ADMINISTRATION

Errata to the Report on the Administration of the Department of Agriculture, United Provinces, for the year ending 30th June, 1919.

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[illegible] Subordinate Agricultural Service, held the charge of the North-Eastern Circle till 21st August, 1918, when, on his appointment as Divisional Superintendent of the Eastern Circle, he was succeeded by Munshi Naib Husain who remained in charge of this circle till the return of Mr. W. N. Harvey, on 20th December, 1918, from military duty. The post of the Agricultural Engineer was held by Mr. F. H. Vick throughout the year.

4. Babu Mohini Mohan Lal, Deputy Collector, remained in charge of the office of my Personal Assistant for the whole year.

5. The term of the appointment of Mr. W. Hulme, Sugar Engineer, was extended for another season and he took over charge at the Nawabganj Sugar Factory on 15th October, 1918, and, after completing the season's work, left the department on 7th April, 1919, from which date his services terminated.

Development of the department.

6. Sanction was given by Government to the increase of the staff of the Agricultural department by 28 members of the Subordinate Agricultural Service and 39 fieldmen. Fourteen vacancies in the agricultural service were filled from past students of the college and the remaining posts will be filled up next year. The services of additional men were urgently required for managing the farms opened from the wheat money grant and carrying on the expanding work of the department. The fieldmen are intended mainly for conducting demonstration work in the districts. The engineering section has been strengthened and formed into a separate branch.

Glossary of crops mentioned in the report.

English or Vernacular names of the crops.	Botanical names equivalent to the English or Vernacular names.
1. Gram	Cicer arietinum.
2. Bajra	Pennisetum Typhoideum.
3. Paddy	Oryza Sativa.
4. Juar	Sorghum Vulgare.
5. Groundnuts	Arachis hypogæa.
6. Sann-hemp	Crotolaria Juncea.
7. Arhar	Cajanus indicus.
8. Bhusa	Straw (English).
9. Kharif	Autumn harvest.
10. Rabi	Spring harvest.
11. One seer=2 lb.	
12. One maund=82 $\frac{2}{7}$ lb.	
13. Kapas	Gossypium Neglectum.
14. Uk	Saccharum Officinarum.
15. Reora	A kind of sugarcane.
16. Paunda	,, ,, ,,
17. Hemja	,, ,, ,,
18. Dikchan	,, ,, ,,
19. Khandsaris	Professional sugar-boilers.

Errata to the Report on the Administration of the Department of Agriculture, United Provinces, for the year ending 30th June, 1919.

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Report on the administration of the Department of Agriculture, United Provinces, for the year ending 30th June, 1919.

No. $\frac{26}{V-359B}$.

FROM

THE HON'BLE MR. H. R. C. HAILEY, C.I.E., I.C.S.,

DIRECTOR OF LAND RECORDS AND AGRICULTURE,

UNITED PROVINCES,

TO

THE CHIEF SECRETARY TO GOVERNMENT,

UNITED PROVINCES, REVENUE DEPARTMENT.

Dated Lucknow, the 10th of October, 1919.

SIR,

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CHAPTER I.

ADMINISTRATION.

Officers of the staff.

2. I remained in charge of the department throughout the year. Mr. H. M. Leake held the combined charges of the posts of the Principal, Agricultural College, Cawnpore, and of the Economic Botanist to Government, United Provinces, till the 16th April, 1919, when he proceeded on combined leave for 10 months, Mr. G. Clarke, the Agricultural Chemist to Government, United Provinces, taking charge of the office of the Principal in addition to his own duties and Mr. W. Youngman, of the post of the Economic Botanist.

Mr. B. C. Burt remained in charge of the Central Circle up to 5th April, when he went on six months' privilege leave, and Rai Sahib Nand Kishore Sharma, the Divisional Superintendent of the Eastern Circle, officiated for him till the end of the year.

3. Rai Sahib Ganga Prasada, the Divisional Superintendent, held officiating charge of the Western Circle in addition to his own duties in place of Dr. A. E. Parr, who is still on military duty. Mr. L. C. Sharma was in charge of the Eastern Circle, during the whole of the year. Babu Brij Lal, a member of the Subordinate Agricultural Service, held the charge of the North-Eastern Circle till 21st August, 1918, when, on his appointment as Divisional Superintendent of the Eastern Circle, he was succeeded by Munshi Naib Husain who remained in charge of this circle till the return of Mr. W. N. Harvey, on 20th December, 1918, from military duty. The post of the Agricultural Engineer was held by Mr. F. H. Vick throughout the year.

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Development of the department.

6. Sanction was given by Government to the increase of the staff of the Agricultural department by 28 members of the Subordinate Agricultural Service and 39 fieldmen. Fourteen vacancies in the agricultural service were filled from past students of the college and the remaining posts will be filled up next year. The services of additional men were urgently required for managing the farms opened from the wheat money grant and carrying on the expanding work of the department. The fieldmen are intended mainly for conducting demonstration work in the districts. The engineering section has been strengthened and formed into a separate branch.

7. Four district farms were opened, viz., at Mainpuri, Muzaffarnagar, Agra and Bahraich. At Raya, in the Muttra district, land has been taken up for a farm to be worked in conjunction with the botanical areas at Cawnpore for trial of new cottons on a field scale. This will be under the Economic Botanist and the existing farm at Kalai in the Aligarh district, which had been used for this purpose, has been made over to the circle officer for a seed farm.

A small area of land has been leased in the Budaun district to demonstrate the growing of more valuable crops from a tube well which has been put down by the department, and another small farm has been opened on the Dhasan canal in the Hamirpur district for growing improved wheats and cotton. Small farms have been also opened for cotton-growing on land commanded by the new canals in the Mirzapur district.

The farm at Madhogarh in the Jalaun district has been closed and operations transferred to a large private farm of the Rampura estate which is more conveniently situated.

8. The policy of opening a farm in each district is being steadily pursued. Experience has shown that the department makes little headway in a district without a resident staff and a central farm which awakens interest by showing new crops, better methods of cultivation, improved implements, pumping plants, etc. Once this interest is aroused, there is no great difficulty in getting the more progressive zamindars and tenants to try the improvements on their land, and to open demonstration farms of their own. The district farm not merely makes the necessary beginning, but it provides the staff on the spot to give assistance when desired. Since, too, the department has had to take over the duty of distributing seed, lending implements, providing for sale of manures, etc., it must have a conveniently situated centre of work, which is best provided by a farm near the headquarters of the district. The opening of such farms is, therefore, regarded as essential for the development of the department and extension of its influence among the agricultural community, and is being pushed on as fast as funds permit.

9. One of the most urgent needs for the proper organization of the department is the breaking up of the existing circles which are unwieldy in size.

The Western Circle, excluding Kumaun, consists of 27,157 square miles with 9,350,749 acres under cultivation, the Central of 31,721 square miles with 8,778, 878 cultivated acres, the Eastern of 21,999 square miles with 7,145,464 cultivated acres, and the North-Eastern, the smallest, of 12,784 square miles with 5,418,821 cultivated acres. The work entailed in managing these circles is beyond the capacity of any one individual. The circle officer tends to become more and more immersed in routine and clerical work, and has insufficient time to supervise his farms, push demonstrations, or carry out new experiments. The sheer impossibility of giving individual attention to large land-owners, anxious to assist by opening their own farms, sometimes gives rise to an entirely unfounded impression of lukewarmness. Application has been made for the appointment of additional deputy directors which will permit of the division of the provinces into circles of workable size.

10. A Board of Agriculture was constituted by Government including representatives of the leading landlord associations and chambers of commerce, and heads of departments dealing with subjects allied to agriculture, such as Irrigation, Forestry and Co-operation. Its functions are to act as advisor to Government and the Director of Agriculture in matters connected with the development of agriculture in the provinces. A sum of money has also been placed at its disposal to be devoted to this object. The Board had one meeting during the year under report.

CHAPTER II.

Agricultural Education.

The Agricultural College.

11. The Agricultural College continues to expand. The number of applications for admission was large, from which the Committee of the Governing Body selected about 50, the maximum number the boarding-houses would accommodate. Some of these failed to appear at the beginning of the session, and the actual number entering was 42, of whom 20 will take up the diploma course, and 22 the two-year cours . Last

year the total numbers were 35, of whom 11 took the diploma course. Six students passed out from the diploma course during the year, all of whom have since obtained employment, and 17 from the vernacular course. Great difficulty continues to be experienced owing to the shortage of staff. Mr. Leake, the Principal, went on leave and was succeeded by Mr. Clarke, who has been compelled to take up the teaching of Agriculture in addition to his own duties as Agricultural Chemist. Mr. Annett, who had previously assisted in the teaching of agriculture, was also on leave. Application has been made for a professor of agriculture, but so far it has not been possible to fill the appointment.

12. The Agricultural College, Cawnpore, as re-organised in 1914 consists of two sections: the higher, or diploma course of four years and the lower, or two-year course, the education given in which is intended to be mainly of a practical character. The latter is not a collegiate course, but it gives a training to a very useful class of men for the lower ranks of the agricultural service, and when it was started there were no staff or buildings for a second institution. At the time, too, it was thought that the practical course would prove most attractive to the landlord class—a body which have it in their power to profoundly influence the progress of agriculture in these provinces. But though the two-year course still remains the most popular, judging by numbers seeking admission, there is a growing tendency for the sons of the well-to-do landlords to apply for the diploma course. As is pointed out by the Principal, of the 20 students admitted to the latter course this year, twelve belong to this class and do not want Government service. The students of the two-year course are taken from the agricultural community, but, with fewer exceptions, they prefer Government service, if obtainable. A certain proportion of these students will be taken off by the Agricultural school about to be opened at Bulandshahr and so relieve the pressure on the college; while a continued increase in the numbers seeking admission to the higher course might necessitate the entire removal of the lower course from the college.

Grant for agricultural education.

13. The grant made by the Government of India for the development of higher agricultural education will be utilised by the addition of two new wings to the college building. One of these will include a chemical laboratory for advanced students and in the other, provision will be made for teaching entomology and plant pathology. Application has been made for a grant for extension and development of the college farm and buildings. Neither the college buildings nor the farm are large enough for the number of students now attending.

Agricultural school.

14. A suitable site for the Agricultural school has been chosen at Bulandshahr with a farm of about 70 acres, irrigable from the canal. Delays have, however, occurred in its construction, owing to the difficulty of procuring building material, and it was not possible to open it during the year.

Horticultural education.

15. The *chaudhri* and *mali* classes at the Lucknow and Saharanpur gardens were well attended and the Superintendents report that there is a good demand for trained men. No difficulty is experienced in finding employment for men who pass out of the schools.

CHAPTER III.

Research and Experiments.

Work on principal crops.

Cotton.

16. The past season afforded another illustration of the extreme precariousness of the crop sown on the rains, comprising ordinarily about two-thirds of the whole. Sufficient rain for sowings was not received in the principal cotton-growing districts until the middle of August, when it was too late for cotton. This is the fourth year in succession in which the rains crop has been a partial failure, and the history of these years is worth recapitulating as throwing light on the nature of the task with which the Agricultural department is confronted in effecting any improvement in the staple and yield of this crop. Long experience has shown the cultivators that cotton should not be sown unless rain is received before the end of one of their sowing periods, which terminates about the 7th July. If sown later,

the maturing of the crop will be cut short by the cold weather and the yield will be at best small; the young plants, too, would make poor growth during what is usually the period of heaviest rainfall in these provinces, viz., from the middle of July to the middle of August. The seasons of 1915 and 1916 were favourable for sowings, but in the former year heavy storms at the end of August nearly ruined the crop: the latter year was continuously wet and all varieties of cotton did badly. In 1917 the weather was normal till the end of July and favourable for cotton. August was very wet and in September such destruction was caused by heavy storms that much of the cotton land was ploughed up for *rabi*. In 1918, as noted above, the monsoon failed. Mention may also be made of the conditions obtaining in 1919, though the year falls outside this report: rain was not received in the western districts until about the 12th July and, though prices of cotton were high, many cultivators would not take the risk of sowing cotton and preferred a late food-grain crop.

These conditions mark out the rains cotton as one of the most uncertain of our crops and therefore one of the most difficult to improve. The cultivators cannot reasonably be expected to take much interest in the improvement of a crop the harvest of which is so precarious: they have a natural preference for the hardiest types, irrespective of the quality of the lint, and for the cheapest possible methods of cultivation. The task before the experts of the department is to produce a cotton at least as hardy and heavy-yielding as the *deshi*, which will thrive on the cultivation given to a crop regarded as a pure gamble, and yet give a lint so appreciably better as to tempt the cultivator to substitute it for his existing types.

17. Of the types put out by the department suitable for the rains crop, the Aligarh white-flowered, which was a selection from *deshi*, commended itself strongly to the cultivators as a hardy, heavy-yielding cotton: the latter quality being so marked that it is now adopted on the farms of the department as the standard for the heaviest-yielding *deshi* cotton. It had also a higher ginning percentage than the ordinary *deshi*, and the *kapas* secured a premium on this account. The staple is however poor, and, as the demand for the lint declined with the cessation of trade with the continent, where it was chiefly used, seed is no longer distributed. K 22 is a hybridised cotton produced by Mr. Leake and is still in the experimental stage. It is obviously most difficult to give a fair trial to a new cotton under weather conditions detailed above: in 1917 it shared the fate of most *deshi* and seed was not easy to recover.

JN 1 is a selected cotton from Bundelkhand, a tract which has been recognised as producing cottons superior in quality to those of the rest of the provinces. It has been very well reported on by the Manager of the Cawnpore Cotton Mills, who stated it to be superior to the best Kulpahar and Kalpi cottons, which have hitherto commanded the highest prices among the cottons of these provinces, and as capable of spinning up to higher counts than the ordinary Bengals. This is being put out widely in Bundelkhand and its suitability for other parts of the province tested.

18. The comparatively stable area under cotton in these provinces is that sown on irrigation before the rains. In this case one of the risks, viz., absence of moisture for sowing, is removed. It has further been shown that, when sown early with irrigation, both the Indian and American cottons develop strong root-systems which enable them to survive better the weather conditions which must be anticipated during the middle monsoon period. This irrigated area must, therefore, be mainly looked to for any definite improvement in the quality of the cotton. The type put out for early sowings is that known as the Cawnpore-American. It is so far mainly confined to the Cawnpore and surrounding districts and has not spread to the Upper Doab. The area increased from 1,600 acres in 1917 to 4,700 in 1918, and to 9,000 in 1919. In this connection it may be noted that the Indian Cotton Committee in their report on the cottons of the United Provinces estimated that it should be possible to bring 100,000 acres under this cotton on the existing canal systems.

The crops as originally sown was mixed in character and a preliminary examination showed that a considerable margin for improvement existed as regards uniformity of lint and ginning percentage. This work has been carried out by Mr. Burt at Cawnpore and has resulted in pure line selections being

obtained, some of which were sent to England for valuation by the British Cotton-Growing Association. The reports on three of these were very satisfactory and indicate that a set of selections of considerable value have been obtained, some of which are suitable for spinning higher counts than was considered feasible with the unselected field crop. One of these, which is agriculturally best suited to the conditions of these provinces, has been sown over an area of 400 acres this season. An account of the work on these cottons is given in *Pusa Bulletin* no. 88 written by Mr. Burt.

The extension of this type of cotton depends on an adequate supply of water for sowings and on marketing arrangements which will ensure the grower the full value of the lint. With the co-operation of the Irrigation department it has been arranged to concentrate on certain channels where a full supply can be ensured. With the aid of an advance from Government as much of the crop as possible was brought in and disposed of to Indian mills after ginning and baling. This arrangement was so far satisfactory that a premium of Rs. 2-8-0 per maund on early picking and Re. 1-4-0 on later was paid to growers. But such transactions not only impose a heavy tax on the department but, in a fluctuating market, involve serious risks of loss. For the coming year a Cawnpore firm has undertaken the purchasing of the *kapas* offered at a fixed premium and its subsequent disposal after ginning.

19. The completion of the Mirzapur canal system has opened a new field for cotton-growing. The trials made this year were not very conclusive, as the cotton was sown late, and it was difficult to obtain labour to weed it. So far, however, as can be judged, the land, which is on a plateau and well-drained, is suitable for cotton ; while, as there is ample waste land awaiting reclamation, there appears a good opportunity of establishing better quality cottons.

Sugarcane.

20. The year 1918-19 was one of the worst possible for sugarcane, except in Benares and Gorakhpur divisions which received better rainfall. Much of the unirrigated cane was a failure and was fed to the cattle. The irrigated cane suffered from the long spell of dry hot weather, and the yield was generally indifferent. All that can be said of the canes given out by the department was that they must have done as well as the rest ; since there was an exceptionally keen demand for seed for sowing the 1919-20 crop and most of the stock of seed was bought up. In some of the private farms of Oudh fair crops were brought through and high profits realised.

21. On the cultural side of the question one or two points have come prominently to notice. Experience of imported canes shows that selected varieties will do well in Upper India for the first few years, but then show an increasing susceptibility to disease : a constant renewal of stock from the country of origin is thus necessitated.

This possibly accounts for the failure of unsystematic efforts made in the past to spread such canes, which in the first instance seemed to be very promising. An effort is being made to overcome this difficulty by applying the Java system of growing for seed in the hills ; so far the plants look healthy and vigorous.

The effect of different soils and climatic conditions on the canes is very marked. Among *deshi* canes, certain varieties have established a definite superiority in particular tracts, but fall off greatly in quality if transferred elsewhere ; as, for instance, *Hemja* in Gorakhpur, *Reora* in Benares and *Dikchan* in Rohilkhand. It would now appear that the similar local differentiation is required with imported canes, and selections will have to be made to suit particular areas. This greatly increases the amount of experimental work, and renders experience gained in one part of the cane-growing tract of doubtful value for another. It may possibly call for the establishment of a new research station.

22. At the Shahjahanpur cane farm the work of testing the new varieties and improving the sugarcane cultivation was continued. Three new canes raised up by Mr. Clarke from cuttings imported direct to Shahjahanpur were given out for trial.

Twenty-two cuttings received from the sugarcane expert, Coimbatore, are under trial in the farm.

An illustrated bulletin dealing with improved methods of agriculture, which have given successful results is under issue. It has been frequently pointed out

that the question of improved cultivation is more important than introduction of new varieties, and particular efforts are being made to demonstrate the value of better methods. They are likely to receive a considerable impetus from the remarkable results obtained in growing wheat on land trenched and manured the previous year for sugarcane; yields of 36 maunds being harvested in two separate localities, though the crop had lodged in places. It is clear that the additional cost of some of the methods recommended will be amply repaid in the following wheat crop.

23. In a year such as that described there was little scope for improving methods of manufacture. In the preceding year there has been some demand for power-crushing mills, and sanction has been given to the importation of a few more for the demonstration purposes. These were lent to the persons interested in cane-cultivation and to one zamindar anxious to start co-operative *gur*-making in a group of villages. The advantages of being able to get through the cane in time and of setting free the bullocks for preparing the land for next year's crop are fully appreciated, and, with a full crop, there is likely to be an increased demand for such plant. Mr. Hulme, the Sugar Engineer, has designed a special type of mill which he believes will be stronger and more suitable for village conditions and give a higher expression than the mills now in use. It is hoped to arrange for a trial in the ensuing cold weather. For private farms of any size mechanically driving mills are essential, and a certain number of persons are anxious, if they can obtain a reliable plant, to undertake crushing on contract for growers in the neighbourhood.

24. Arrangements were made to supply 30,000 maunds of cane to the Nawabganj Sugar Factory, but the crops proved a failure and only 8,000 maunds were obtained, half of which came from the farm of the department. Some of the cane received from the villages was extremely poor, and it was decided to make the bulk into *gur*: the molasses of the first sugar were also made into *gur* and commanded a fair price. The cost of the cane plus cartage was Rs. 3,000; sugar and *gur* sold for Rs. 7,981, leaving only a small margin of profit in consequence of the high cost of establishment and fuel, the latter being necessitated by intermittent running. Some offers have been received for the plant and a group of landlords owning private farms in Oudh have applied for its transfer to their district, undertaking to supply sufficient cane to keep it running. It has, however, been decided to keep it for another year at Nawabganj to clear off advances.

Wheat.

25. This crop is one of the most secure of those grown in the provinces and, consequently, one of the easiest to improve. The Pusa wheats and Cawnpore 13 having shown a definite superiority in point of yield to the existing types, the first efforts to improve the wheat crop took the form of spreading these types as widely as possible. After preliminary demonstration, Pusa 12 became popular in the central districts and Lower Doab; while Pusa 4 established itself in Bundelkhand. They are less suitable for the submontane districts, for which new wheats are being tried. The next step was to organise a supply of seed on a large scale. This year 40,000 maunds of seed were sold from the seed dépôts. They are now spreading rapidly of themselves. It is difficult to obtain any statistics regarding the area under these wheats without a village-to-village inquiry which would occupy too much of the time of the staff. In some parts of Oudh and the Lower Doab they have practically superseded *deshi* wheats, but have made less headway in the western districts. They are grown almost exclusively at the private farms, and the seed is regularly distributed to tenants on the estates. The problem with regard to these types has now somewhat changed—it is no longer to popularise them, but to maintain purity and demonstrate how they can be grown to the best advantage. The bulk of the cultivators who grow them have still to learn that their principal value lies in their higher potentialities of yield under good cultivation, as compared with the weak strawed *deshi*, and that they have not done all that is necessary in substituting one variety for another. Admitting that this substitution of itself will raise the general standard of yield, there yet remains a wide margin between the average outturn and the standard regularly attained at the farms of the department. Demonstration is accordingly given of the increased yields obtainable with proper tillage and manuring. In this matter the private farms give great assistance. By the use of improved

implements and manures, quite as good yields are often obtained as those of our farms and there is a friendly rivalry to surpass them. This year a yield of 32 maunds per acre was reported on the farm of Thakur Jagannath Baksh Singh which would have been unheard of a few years ago and, though it was not a good year, others obtained outturns, between 20 and 25 maunds. These are big yields in a province which rarely forecasts even 11 maunds per acre. The small tenant may not have the money or cattle to make much improvement, but in the ranks of the farming community there are many, such as small proprietors and large tenants, who have the means and are likely to follow an example when brought to their doors.

Some new types of wheat received from Mr. Howard, Imperial Economic Botanist, are under trial at Cawnpore.

Rice.

26. Owing to the character of the season both the varietal and manurial experiments with rice gave inconclusive results, while much of the *juar*, *bajra*, and *arhar* failed. Pusa grams no. 17 and 18 and tobacco no. 29 continue to do well and are in demand. The two former are vigorous, heavy yielding varieties.

Hill potato.

27. Steps are being taken to improve the hill potato crop, which is of considerable commercial importance, large quantities being exported to the principal towns of these provinces and to Calcutta. The original seed was brought out from England in the eighties and has not been renewed. The crop for some time past has been showing signs of deterioration. There is no farm of the department in the hills, but Mr. Gill, Superintendent of the Chaubattia gardens, has imported a number of varieties and those found suitable are being multiplied and the seed distributed. Growers are for the most part keenly alive to the value of fresh seed, and that available is readily disposed of.

Poppy.

28. The investigations regarding the improvement of the morphine content of Indian opium have been continued at Cawnpore under Mr. Annett and, after his departure on leave, by Mr. Sen; the botanical aspect of the problem being investigated by Mr. Leake. They are conducted on behalf of the Opium department and the results communicated direct to that department. On the value of the pure line selections brought out by Mr. Leake, Mr. Sen writes: "in some districts Mr. Leake's pure races were grown under supervision of the opium officers: in all places they have been tried, they have kept up their quality. Where the local varieties yielded rather poor opium, the Cawnpore breed has yielded markedly better results. Thus, as observed in last year's report, the race of the plant seems to be an important factor on which the morphine content depends."

CHAPTER IV.

Assistance to Public.

Demonstration.

29. The lines on which demonstration is being carried out will appear from the previous paragraphs. The department, having begun with the distribution of selected varieties and having shown that a certain increase of yield is possible by growing them, is now trying to attack the larger problem of improved cultivation. It is being impressed on the cultivators that a change of varieties alone will not carry them very far. But the introduction of any change in practice, which may often involve the use of new implements, is necessarily a slower process than the introduction of a new variety, and calls for more thorough demonstration. Field demonstrations are given of the correct use of iron ploughs, light cultivators and lever harrows, interculture of cotton, ridgers, and trench-making implements for cane-cultivation. Demonstrations are also given of the value of cake manures and, in certain areas, of green manuring. For this class of work the opening of a number of demonstration farms is hardly necessary: in course of time the more enterprising agriculturists will prove the best demonstrators. But, as a beginning has to be made, demonstrations are arranged in villages, or implements are lent to cultivators who are taught their use by fieldmen, or, where there are private farms, the owners of which are willing to co-operate, trained men are lent to supervise their working. The increase in the number of fieldmen has been of very material assistance in organizing these demonstrations and helping landowners in managing their farms.

But no rapid progress is probable until implements are obtainable in larger quantities and at cheaper rates.

Seed and manurial cake dépôts.

30. There was a good demand for seed from the seed dépôts and in all 64,000 maunds were sold, exclusive of cane sets. The bulk of the seed consisted of Pusa wheat.

Ten cake dépôts were opened last year at convenient centres for the sale of cake manures. At the beginning of the year they were stocked at moderate prices and there was a good sale to potato and cane-growers. Later on in the year, the price of castor cake rose rapidly and it was being sold at Cawnpore at Rs. 2-12-0 per maund, as against Re. 1-8-0 at which the stocks were bought. This price is prohibitive to the bulk of the growers. A comparatively cheap nitrogenous manure is essential for supplementing the supplies of farmyard manure in growing the more valuable crops, and the rise in prices of all cakes—for the price of other cakes followed the same course—is a serious hindrance to the efforts made to popularise the use of cake manures. An adequate substitute can probably be found in *neem* cake, the nitrogen content of which is about the same as that of castor cake, viz., 5 per cent. to 6 per cent. The tree is one of the commonest in the provinces and the supply of seed cheap and inexhaustible. At present the oil is expressed mainly for medicinal purposes, and commands a comparatively high price. If produced in larger quantities, this price would not be maintained; but the Industrial Chemist, who has examined the oil, considers it could be refined so as to be used for industrial purposes. A proposal has been put before the Board of Industries to start a small factory for working the seed. The cake, where procurable, is preferred to others by the cultivators under the idea that it keeps off white-ants.

Sale of implements.

31. The supply of implements was uncertain and prices high. It was not therefore possible to keep the dépôts regularly stocked. A grant has been made by the Board of Agriculture, United Provinces, for the purchase of approved implements with a view to popularising their use among cultivators.

Co-operative societies.

32. A small number of co-operative societies, mainly in the Central circle, have continued to engage in seed-distribution. The most successful of these are the Sandila, Hardoi and Jasrana banks. Few of the banks are prepared to do more than sell seed grown, or bought in, by the department; they thus act rather as adjuncts of the department than as co-operative supply associations, carrying on a business of their own. The development of the co-operative sale of produce and of agricultural requisites in these provinces has been slight. This may be, in part, due to the constitution of the central banks which unfits them for undertakings of this nature; but it must be recognised that such operations call for business capacity and a special knowledge of rural conditions, and there is no certainty that, if separate organizations are formed for conducting them, they will be any more successful than the central banks. The experience of the few really successful societies points to the fact that individual initiative must be looked to for organising them at the start. What is wanted for the development of such societies is competent men of influence, prepared to help their poorer neighbours to combine and prove to them the value of combination.

Private farms.

33. This term is applied generally to farms opened by zamindars which they are prepared to run on modern lines with the assistance and advice of the department. They are more numerous in Oudh than in the Agra province, estates being larger in the former province and subordinate tenures less numerous. In the Agra province landlords, who are both interested in agriculture and alive to the profits to be made from it, often find it difficult to obtain compact areas for farms.

The Oudh farms are expanding and one of the most promising features is that, to provide for the extensions, waste, or highly precarious land, is being taken up and improved. This has necessitated the wider use of machinery, as it is impossible to irrigate large areas from bullock-lifts, or to thresh out the wheat crop by the ordinary method before the rains set in. Some have undoubtedly been hampered by the difficulty in obtaining plant, and a certain number of taluqdars are only waiting till pumping plant is procurable before starting operations. The year was one which tested the management severely and the results obtained, in spite of difficulties of scarcity of water and labour, reflect great credit

on their owners. Some of those I visited, such as the farms of the Hon'ble Raja Sir Rampal Singh, Thakur Jagannath Bakhsh Singh, Sirdar Nihal Singh and the Raja of Amethi, had large blocks of wheat of fine quality, which presented a striking contrast to the cultivators' crops in the neighbourhood. These gentlemen, in addition to meeting their tenants' requirements, were able to supply a large order for the Behar Agriculture department.

In the Agra Province, the Hon'ble Nawab Muzammil-ullah Khan has continued to develop his scheme for reclaiming a large area of waste land by introducing power pumping. A farm for growing American cotton and wheat has been opened by Babu Adya Saran Singh in the Fatehpur district. The Agricultural Engineer has been called in to draw up schemes for irrigation with a view to opening farms in other estates. A more detailed account of the working of some of these farms is given in appendix no. 3.

As has been pointed out in previous reports, these farms, apart from their value as showing a growing interest in agriculture on the part of the landlords, form a most useful connecting link between the department and the agricultural community generally. They are opened with the definite idea of trying new varieties of crops, new methods, and new machinery. Further, they are leading to the opening up of fresh land for cultivation. There are considerable areas which could be profitably cultivated by capitalistic enterprise, such as high sandy tracts which tube wells would render culturable, scrub jungle or heavy land infested with weeds which the ordinary plough will not touch. Some of the farms have been made out of the two former classes of land and, as the undertaking has proved profitable, the example is likely to be followed.

Land improvement.

34. Land improvement schemes are being carried out in Oudh on the reclamation of certain class of *usar* land and, in Bundelkhand, on the reclamation of land eroded by the action of water channels. In the former, it has been found that, if the land is ploughed deeply before the rains and arrangements made for drainage, the surface salts are partly washed away and, after manuring, the land in the second year will bear certain classes of crops. The work requires mechanical power for the ploughing and a tractor plough has been procured for the purpose.

Large areas have been rendered waste in Bundelkhand within quite recent years by the scouring action of water running into the drainage channels and smaller rivers. The zamindars have been in the habit of erecting small *bandhs*, but large works are beyond their power. An area has been selected for operations in the Jalaun district which is periodically subject to famine. The construction of the *bandhs* will be undertaken by the Irrigation department, which has appointed a special officer for the purpose. The lower levels will, after the water has run off, be let out for wheat-growing; while the land on the sides will be ploughed up and kept for grass. In one of the first of these constructed near Orai, some 30 acres of land will be available for wheat growing this year and about 60 acres have been put under grass.

Agricultural Engineering.

35. The season just past was the first in which power-pumping for irrigation was used on any considerable scale in a year of drought. Thanks to the activities of the Engineering branch, a number of tube wells and pumping installations had been put down since the last famine of 1913, and, when the rains failed, there was an urgent demand on the department to provide drivers, spare parts, to undertake repairs, make arrangements for oil, etc. The task was greatly enhanced by sickness among the staff, but, on the whole, a good number were got going and did excellent work throughout the cold weather. Every available engine was lent and 12 pumping sets were temporarily installed on rivers and tanks to bring as large an area as possible under crop. There was a great wastage of water, owing to the absence of proper channels, but, on a moderate estimate, some nine to ten thousand acres were saved. The largest area was irrigated on the estate of the Hon'ble Nawab Muzammil-ullah Khan, where there is a 30 H -P. engine pumping from a tank fed from the canal. Some of the strainer tube wells did well. That at Tateora, in the Hardoi district, irrigated 62 acres during the *kharif* and 233 in the *rabi*. The tube well at Shitabnagar in the Budaun district irrigated 150 acres of wheat without channels, two waterings being given in each case. Several others commanded about 100 acres. More could have been done in all cases had proper channels been constructed.

The conditions were all against a marked success, but the continuous applications for the loan of plant throughout the cold weather show that the value of this form of lift is becoming appreciated.

36. As this is the fifth year since the agricultural engineering branch came in existence in these provinces, a brief account of what it has accomplished may fittingly be given. Lift irrigation by mechanical power was started by Mr. Parr, Deputy Director of Agriculture, Western Circle, a few years before the appointment of Mr. Vick as Agricultural Engineer. In parts of that circle, the subsoil strata are very favourable for well-construction, and the wells, after being bored, were found to stand the strain of power-pumping. A certain number of engines were installed on wells for zamindars, who found they could irrigate their own land and sell water profitably to their neighbours. A company, named the Pali Engineering Company, was founded to put down engines and pumping plant, and has specialised in the form of well known as the Chaudhri tube well. On Mr. Vick's appointment, he found that at least 50 per cent. of the wells of the provinces were resting on sand and were giving only one *charsa* of water or less, and that, except in limited tracts, the wells would not stand power pumping. In any case, pumping from existing wells afforded no means of protecting precarious dry tracts. He accordingly commenced experiments with tube wells and the insertion of strainer in masonry wells, after making borings to improve the yield. They quickly prove their undoubted value in the sandy tracts, which are among the most precarious in the provinces and the first to feel the effects of famine. After some demonstrations had been given, applications were received in large numbers; but difficulties of procuring boring plant and machinery increased during the war, and it has not been possible to comply with more than a limited number of requests for installations. In spite of the adverse conditions 61 strainer tube wells have been put down, and 41 pumping plants have been installed over rivers, large tanks or existing masonry wells by the Agricultural Engineering department. Some 30 engines and pumps, mostly of small power, have been installed on wells by the mechanical staff of the circle, mainly in the Western districts. The value of the strainer tube in these provinces lies in the fact that there are large tracts in which either the clay "*mota*" for the foundation of the ordinary wells does not exist at all, or occurs very irregularly. Here, the existing wells can be improved so as to yield enough water for four *charsas* by insertion of a strainer; while a deep tube operated by power pump affords a means of protecting, or actually reclaiming large areas of poor precarious land. The interest which has been aroused by this form of well improvement may be judged from the fact that the Agricultural Engineer has a waiting list of 500 names, scarcity of plant of all descriptions making it impossible to meet their demands.

Well boring.

37. The operations of the well-boring establishment which is engaged on testing sites for new wells and improving existing wells were greatly hampered by scarcity and high prices of all forms of plant. In all 253 sites for new wells were tested and 67 existing wells bored, the supply being definitely increased in 487 cases.

CHAPTER V.

MISCELLANEOUS.

Expenditure and receipts of the department.

38. The total expenditure of the department was Rs. 10,85,020 as compared with Rs. 7,70,290 in the previous year, which includes the cost of acquiring land and opening new farms from the wheat grant. The receipts rose from Rs. 90,557 to Rs. 1,07,812.

Agricultural publications.

39. No bulletins were published during the year under report. Other English and Urdu publications by the department are detailed in appendices II, III and VII.

I have the honour to be,

SIR,

Your most obedient servant,

H. R. C. HAILEY,

Director.

APPENDIX I.

Report on the administration of the Western Circle of the Agricultural Department, United Provinces, for the year 1918-19 *by Rai Sahib Babu Ganga Prasad, Officiating Deputy Director of Agriculture.*

The circle was in my charge throughout the year. It has agricultural stations in the following districts:—

Aligarh.	Muttra.
Bareilly.	Bulandshahr.
Agra.	Saharanpur, and Muzaffarnagar.

The Kalai seed farm in Aligarh was also transferred to me by the Economic Botanist during the year under report.

Demonstration plots were maintained on the tube wells in Budaun and Etah.

The experimental and demonstration work done by the Government farms has been detailed in the annual report on the agricultural experimental stations of this circle.

District Work.

On the observations and recommendations of the India Cotton Committee the white-flower Aligarh country cotton was not encouraged. Efforts were made to encourage the cultivation of the Cawnpore American cotton and the K-22 on a larger scale by distributing their seed.

American cotton.—Fifty maunds of its seed were obtained from the Deputy Director of Agriculture, Central Circle, Cawnpore, about 20 maunds were received from the Hon'ble Nawab Muzzamilullah Khan, Khan Bahadur, of Bhikhampur. This was given out for sowing, but it is not certain that the cultivators who took it sowed all because there was shortage of canal irrigation at the sowing time and the sowing season was unusually very hot and dry.

K 22.—About 153 maunds of its seed obtained from the Kalai seed farm was given out, of which about 80 maunds was distributed from the new seed godown started at Bilram in the Etah district.

Sugarcane.—The following quantities of the sugarcane seed were distributed from the different farms:—

Farm.	Thick cane. Mds.	Thin cane.	J. 33.
Bulandshahr ..	67	..	..
Muttra ..	195	53,520 canes in number	..
Agra ..	101	98,400 top sets and 1,430 maunds whole canes.	1,400 top sets and 263 maunds whole canes.
Nawabganj (Bareilly) ..	109	..	..

Wheat.—Total quantity of wheat distributed as seed was 2,876 maunds, out of which 2,254 maunds was Pusa no. 12; 581 maunds Muzaffarnagar, and 41 maunds of other varieties. Other *rabi* seeds such as oats, grams, barley, and carrot seed were given out in small quantities.

Among the other *kharif* seeds castor seed 403 maunds, groundnuts 35 maunds, *juar* 36½ maunds, maize 11½ maunds, and early *arhar* 5 maunds were supplied.

There being scarcity of fodder lucerne, grass seed was much in demand and about 18 maunds of it procured from outside were supplied to the cultivators and the military officers.

Implements.—The demand for Meston ploughs continued and 78 of these were sold. More could not be had from the makers and their prices have gone up very high. The demand for other implements was insignificant, a few Archimedian screw pumps made at the Nawabganj, Bareilly Farm, were also supplied. The Lever harrow and the spring lever cultivator known as the Raja Hoe were demonstrated on private farms. The labour-saving appliances devised at the farms for making trenches for sugarcane were also demonstrated.

By the use of these appliances the cost of trench-making and trench-cultivation has been brought down and the difficulty of getting labour is to a certain extent mitigated. These appliances are worked by bullocks and are so simple as can be made by the village carpenter. Some of them are simply attachments to the ordinary country plough.

Pumping plants.—There being no new engines available no progress in the supply of new plants could be made, but every possible effort was made to keep the existing plants going.

Repairs were promptly done and spares were supplied from the Bulandshahr, Aligarh, and Nawabganj farms. A small staff of mechanics maintained in the circle was always busy in giving help to the engine-owners. There was considerable difficulty in getting kerosine oil at reasonable rates and in the time of drought some of the engines had to stop working. In order to avoid this difficulty arrangements were made to get oil from the companies, stock it and supply at the companies' official rates. This action proved of material assistance to the engine-owners and they were able to raise crops of considerable value which they could

not have done without the engines in the dry year. They reaped good harvests and obtained high prices for their outturns.

On the Budaun tube well an area of about 150 acres was put down under wheat with the help of this well. Without this irrigation not a single furrow of that land could have been sown, because there was no moisture on account of failure of rains. The value of the produce obtained with this tube well can be calculated at about 15,000 rupees for the whole year, which is much more than the cost of the tube well. A few fields round there taken from the cultivators were cultivated by the department and sown with maize and cotton in the *kharif* and with the Pusa wheat no. 12 in *rabi* as a demonstration. These did excellently and set a good practical lesson to the other cultivators. Similar demonstrations are continued on new fields belonging to other cultivators.

A sum of Rs. 600 was spent in supplying water from the pumping stations to the cultivators as a relief against famine for sowing wheat. It was spent mostly at Saharanpur and Bilram, district Etah.

Seed godown.—A new seed godown has been built at Bilram about four miles from Kasganj on the Kasganj-Bilram metalled road in the Etah district. The land was given free by Kunwar Raghubir Singh of Bilram and the cost of its erection being met by the department. It was formally opened on 6th of May, 1919, in the presence of a large gathering represented by all classes of people of the district of Etah. The Collector, Mr. D. M. Stewart, and Mr. A. H. de B. Hamilton, District Judge, had taken active part in the establishment of the seed godown. It is expected that this seed godown will serve as a seed distributing centre for Etah and the neighbouring portions of the Aligarh and Budaun districts so far as they are connected by means of the Rohilkhand and Kumaun Railway, Bombay-Baroda and Central India Railway and metalled roads.

Sugar factory.—The sugar factory was worked by Mr. William Hulme, sugar engineer expert to the Government of India at the Nawabganj farm, Bareilly, during the cane-crushing season. The cane was supplied partly by the farm and partly from the cultivators. It was a bad year for cane so only inferior and insufficient cane could be had for the season.

Mr. Hulme manufactured some sugar in the beginning of the season. He devoted the later part of the season on the manufacture of *gur*.

A Chattonooga sugarcane crushing mill obtained from the agricultural engineer's stock was worked by Mr. R. R. Manglair, Bar.-at-Law, Budaun, at his village Sadarpur by a steam engine. This machine gave constant trouble and has been found inefficient. A new mill of the same make ordered from makers in America was received at the end of the crushing season and has been sent to the Hon'ble Lala Sukhbir Singh of Muzaffarnagar.

Mr. Hulme, the late sugar engineer expert was asked to devise a suitable mill for the Indian cultivator to be worked by an oil engine. A trial mill designed by him is expected shortly. There is likely to be a good demand for a really efficient strong mill.

APPENDIX II.

Report on the administration of the Central Circle of the department of Agriculture, United Provinces, for the year 1918-19 *by* MR. B. C. BURT, B SC., M.B E., *Deputy Director of Agriculture.*

Staff.—I held charge of the circle until 5th April on which date I proceeded on leave, Rai Sahib Nand Kishore Sharma officiating for me. Some further additions were made to the junior staff during the year passed students from the Agricultural College being appointed to the Subordinate Agricultural Service. Some additional fieldmen were also appointed.

Farms.—The extension of the Central Seed Farm at Kalianpur is now complete and additional buildings and stock provided and all the new land will be under cultivation during the coming year. The new Mainpuri district farm has been brought under cultivation.

DISTRICT WORK.

Wheat.—The systematic introduction of Pusa 12 and Pusa 4 wheats, the former in the *doab* and Oudh portions of the circle and the latter chiefly in Bundelkhand, was continued; issues of seed from stores controlled by the department aggregating 25,374 *maunds* (about 34,000 bushels) of these two varieties, viz., Pusa 12 15,545: Pusa 4 9,829. The quantity of seed issued shows an increase of 50 per cent. on the previous year, but this by no means represents the extension in area. The absence in many tracts of suitable co-operative organization for seed-supply has thrown the burden of seed-distribution in many areas on the department but by concentrating effort we have now reached a stage where many villages are growing practically no other wheat and are largely independent of departmental supplies except to maintain purity. A steadily-increasing number of zamindars are growing considerable areas of these wheats—particularly Pusa 12—for distribution to tenants. A large majority of these zamindars' fields have been inspected and rogued and form an increasingly important means of distributing seed of improved crops. There are relatively few large estates in the circle, but with an increase in district staff it will be possible to gradually organize a number of these small farms either into seed unions or as certified seed farms.

On what is perhaps the most important point, viz., the extent to which these wheats are spreading naturally, I have obtained abundant qualitative evidence during the tours of myself and my staff, but figures are hard to obtain without a village-to-village enquiry for which staff is not available. All that can be said is that Pusa 12 wheat in particular is spreading rapidly and that 100,000 acres is probably a very conservative estimate of the amount now grown in the circle.

In Bundelkhand Pusa 4 wheat has again been a marked success on the Ken, Dhasan, and Betwa canals and we are again greatly indebted to the Canal officers and staff for much assistance in the distribution of seed.

Cawnpore 13 wheat has been in considerable demand in certain limited areas for which it appears particularly suited and 1,742 *maunds* of seed of this variety were issued.

For the unirrigated black soil areas in Bundelkhand we have at present no wheat that has been a marked success.

Cotton.—The extension of Cawnpore-American cotton was continued and, as in the previous year, arrangements were made with the Irrigation department to confine operations to the areas served by selected guaranteed channels. As a result of the successful working of this system there was an increase in area sown from some 1,600 to 4,700 acres.† But for a shortage of reliable seed (due to the previous season being exceedingly unfavourable to all cottons) and transport difficulties the area would have been larger. The crop was estimated at 1,600 to 1,700 bales, but this does not represent the yields obtained by those growers who treated their cotton fairly. The season was the driest for 40 years (the rainfall during the monsoon period being some 7" only as compared to a normal of about 28") and consequently not only did cotton require irrigation water in July and August, but all *kharif* food crops required irrigation prior to sowing. The demand for canal water was consequently far in excess of the maximum possible supply and a number of cultivators gambled on rain coming later and utilised the available water for other crops to the detriment of their cotton (whether *deshi* or American). A considerable area of cotton gave nominal yields only, whilst in the same villages American cotton that received irrigation water gave average yields of 700 to 800 lbs. of *kapas* (220 to 250 of ginned cotton) per acre whilst yields as high as 1,500 lbs. of *kapas* (465 ginned cotton) were secured by some of the best growers.

As in the previous year, the department purchased all American *kapas* offered, arranged the ginning and sale, the transaction being financed by an advance from Government. The quantity handled by us aggregated 887 bales (of 400 lbs.) all of which was disposed of at good prices to Indian mills at prices * well above market quotations for fine Broach and Punjab American. Inflated prices for *deshi* cotton and extreme variation of prices made these operations difficult but a bonus of Rs. 2-8-0 per cotton *maund* on the early and main crops and Re 1-4-0 on the later pickings was paid to growers and the transactions completed at a small profit. From September to December, *deshi* cotton varied from Rs. 16-8-0 to Rs. 29 per *maund* and on three occasions the variation per week exceeded Rs. 5 per *maund*. Under these circumstances premiums for quality were heavily discounted, but growers were satisfied with their American cotton on account of the higher yield.

* 40-100 Rs. per candy above F. G. Broach.
† 8,100 acres in 1919.

For the coming year arrangements have been made with a firm of ginners to purchase all American *kapas* offered at a premium and to dispose of the cotton subject to the supervision of the department. Ginning factories have been arranged for at five convenient centres. This arrangement will relieve the department of the responsibility for the purchase of *kapas* except in respect to some 400 acres of the selected strain C. A. 9 to which reference is made below.

J. N. 1. This selected *deshi* cotton has been thoroughly tested in Bundelkhand during the year under report and multiplied at the Central Seed Farm for distribution. The whole of the available stock of seed is being distributed for the 1919 sowing season on the Bundelkhand canals where a limited supply of water for cotton sowings has been promised. The maximum possible area is being put under pure seed at the Central Seed Farm and on the Bundelkhand farms for multiplication. A practical spinning and weaving trial in Cawnpore to which more detailed reference is made below shows that this cotton which has successfully spun 18's warps and 20's wefts is admirably suited to the requirements of local mills and is considerably superior to the best Kalpi. The establishment of this variety in Bundelkhand is now being energetically taken up.

K 22 *cotton.*—The further trial of this cotton in Hardoi and Unao districts was rendered impossible by the failure of the monsoon as these districts cannot irrigate cotton. Grown under irrigation on the Cawnpore, Hardoi and Etawah farms it yielded very well; the only seed sown being the re-selection K 22/40. In Etawah district a limited amount was grown with canal irrigation and yielded well. Seed was issued for 581 acres in all.

It will be seen from the above that active steps to establish three cottons of improved staples are being taken in the circle each being limited to a well-defined tract. Progress, however, must largely depend on the extra price which the trade is willing to pay for such cottons and on adequate marketing arrangements to ensure the cultivator the full value of the improved staple.

Sugarcane.—Although the circle includes none of the typical sugarcane growing areas of the province, the crop is of local importance in several districts. As in previous years the whole of the supply of cane sets from the various farms was rapidly taken up and total issues aggregated 2,276 *maunds*. Unlike such seeds as cotton, this represents a larger step in the introduction of superior varieties than the actual quantity indicates. The difficulty in transporting large quantities of cane seed are considerable and the cost often prohibitive, consequently each individual is supplied with sets for small areas only from which he saves his own cane for sowing in the following year.

In the Sitapur district there appears to be a probability that with the introduction of tube well irrigation cane growing can be revolutionised. The experience of the past few years with improved canes from the Agricultural Chemist's sugarcane experiment station at Shahjahanpur has clearly shown that the results obtained by cultivators with improved varieties of cane have been uncertain. This has been shown to be due to inadequate cultivation and, in some cases, absence of irrigation facilities. Arrangements have therefore been made for organised demonstrations of correct methods in the Katesar State (Court of Wards) where the irrigation supply is assured by three tube wells.

Rice.—Little progress has been possible on the Ken Canal during the year under report as the failure of the rains made sowings almost impossible. Nor is rice growing with canal irrigation in a famine year a policy to encourage in this tract, since rice requires approximately four times as much water as any other food crop under conditions of extreme drought. Seed of selected varieties for 150 acres was issued.

Other crops.—In addition to the more important commercial crops mentioned above considerable quantities of seed of improved varieties of juar, maize, bajra, arhar and tobacco (Pusa 28) have been distributed. The seed rate being relatively low the quantities of seed handled are much lower than for wheat, and as cultivators more frequently keep their own seed of these crops the demand for seed is less urgent. Nevertheless more could have been done with a selected Cawnpore juar, with awned bajra and with maize had greater facilities been available for growing the required seed whilst with a limited staff it was only possible to arrange demonstrations in those areas where other work was in progress. In regard to juar and maize it is hoped to receive considerable assistance from the new Lucknow Sewage Farm when the latter comes under cultivation.

General demonstration work.—There are now 19 touring assistants in the circle as against 17 last year and by placing at their disposal trained labourers from the Government Farms for village work it has been possible to considerably increase the number of satisfactory demonstrations while much of these assistants' time is taken up with seed supply organisation for major crops. There is abundant evidence that their services are being more and more appreciated in regard to other agricultural problems. Having obtained the confidence of the larger cultivators through the introduction of improved crops they now obtain a ready hearing when advocating improved methods of cultivation. But the introduction of such methods involving the purchase of additional implements in many cases is necessarily a slower process than the introduction of an improved variety of a crop and requires more thorough and detailed demonstration. The principal demonstrations, apart from the introduction of improved crops, included the harrowing of wheat after the first irrigation to save irrigation water, the use of the ridger for irrigation *mends*, green manuring, the use of castor cake, drill sowing of cotton, interculture of cotton, improved methods of *gur*-making, correct use of iron ploughs and hot weather cultivation for wheat.

Seed and Demonstration Farms.—Working expenses on the Central Seed Farm amounted to Rs. 14,742 and receipts to Rs. 13,826 (as compared to Rs. 7,999 and Rs. 7,626 for 1917-18), but these figures do not represent the year's working correctly as new land was brought under cultivation and the receipts for the larger wheat crop comes into the next year's accounts. Nor was the farm able to take full advantage of the high prices of cotton since the bulk of the produce was reserved for spinning trials (one in Lancashire), thus losing the early market.

The departmental farm at Etawah was maintained, as in previous years, chiefly for demonstration and seed growing, but partly for local variety testing. This farm again worked at a profit and has been of the utmost value in connection with local demonstration work.

At Hardoi a demonstration farm of 40 acres is run in co-operation with the District Board and has shown a net profit of Rs. 1,222 after paying a rent of Rs. 577 for the land; the land has since been acquired; an irrigation tube well installed last year has been of the greatest value during the past season.

At Mainpuri the new demonstration farm, which will be run as before in co-operation with the local Agricultural Society, has been brought under cultivation during the year and the old farm (on rented land) surrendered to the original tenants. A tube well for irrigation purposes is under construction.

Court of Wards estates.—Demonstration and Seed Farms are maintained by two Court of Wards estates, viz., Harchandpur in the Etawah district and Rampura in Jalaun. Both of these have done most useful work in connection with wheat and cotton demonstrations and seed supply during the year. A large demonstration area under the cultivation of tenants has been organised on one of the tube wells in the Katesar estate (Sitapur Court of Wards) and will form a nucleus for demonstration work in that estate for which a special assistant has now been posted. A farm in the Banda Court of Wards is being managed by the ward, an ex-student of the Agricultural College, with the assistance of the department. Particular mention should be made of the excellent seed store and distribution scheme for Pusa 12 wheat which is being worked by the Katesar estate, Sitapur. The department is indebted to the Special Manager, Mr. Dunne, for his hearty co-operation in this and various other ways.

The Harchandpur estate in Etawah district is constructing its own seed store in connection with the estate farm, and in the meantime is working a seed distribution scheme in conjunction with the department which has materially assisted our operations.

The Rampura State Farm, Jalaun, grows and distributes considerable quantities of seed for distribution to tenants, and has also been able to hand over a surplus to us for general issue. This farm, situated as it is in the best cotton tract of the district, will be of great importance in the establishment of J. N. 1 cotton, provided that an adequate irrigation supply can be assured.

Private farms.—As in previous years the Macha Farm (Cawnpore district) stands out as an example of a very profitable little undertaking run by a cultivating zamindar on modern lines with our assistance and advice. The Raja of Baraon also maintained an estate farm in the Allahabad district for demonstrations to his tenants. The number of cultivating zamindars who grow crops recommended by us and by our methods has again increased considerably, and many of these would gladly convert their holdings into compact farms if possible. In the Fatehpur district a farm of considerable size, chiefly for American cotton and wheat, has recently been started by B. Adya Saran Singh of Jahanabad. As in past years we are indebted to a number of cultivating zamindars for assistance in seed supply.

Co-operative societies.—The Sandila Central Co-operative Bank has continued to work successfully a seed store for the benefit of its constituent societies, although transactions have been on a much smaller scale than was anticipated. By arrangement with the Hardoi District Bank the Agricultural Superintendent has this year dealt direct with the primary societies in agricultural matters with considerable success. The Jasrana Central Bank has again successfully managed a seed store for its members, largely owing to the initiative and ability of the zamindar, who is the manager. The Mainpuri Agricultural Supply Society has purchased, stored and issued considerable quantities of Pusa 12 wheat, but it is still doubtful if this society, consisting as it does of zamindars chiefly, is an ideal organisation for seed supply.

The question of separate co-operative organisations, independent of the credit societies for seed and implement supplies, will require special investigation in the near future. It is now clear that the central banks are often not sufficiently in touch with rural conditions to undertake the business, and further, there are practically no co-operative credit societies in some of our most important districts.

Strainer tube wells.—The demonstration tube well at Tateora, district Hardoi, was worked departmentally throughout the year and under famine conditions converted a most precarious village into one of the most prosperous in the district. Sixty-two acres of *kharif* irrigation and 233 acres of *rabi* irrigation was successfully carried through under conditions of extreme drought. In spite of the rise in the price of kerosine oil and stores the well has paid its way, except for expenditure on the maintenance of channels which is more than covered by the voluntary rate paid by the zamindars.

The tube well at the Hardoi Farm also supplied water to cultivators for some 25 acres.

A tube well installed for a local zamindar irrigated about 80 acres and similar areas were done by the tube wells belonging to the Court of Wards estates in Sitapur.

The Safipur tube well working under very unfavourable conditions irrigated 40 acres of *rabi*. This experimental well was not satisfactory and would have been modified but for the famine conditions.

It is now established that there are numerous areas for which strainer tube wells are a most profitable investment. A matter of pressing importance is some cheap and efficient method of lining channels to prevent waste in sandy land—a point which is now receiving attention.

Manures.—A dépôt has been started at Cawnpore for the supply of castor cake (and other suitable manures) with subsidiary dépôts at suitable centres. Castor cake when obtainable at a moderate price is a most profitable manure not only for such crops as sugarcane, tobacco and potatoes but for other crops also. Demonstrations have been arranged in the vicinity of the sub-centres.

Green-manuring for wheat with sann hemp is steadily progressing in favour in parts of Cawnpore, Hardoi and Banda and is constantly demonstrated in suitable areas.

Implements.—Short and uncertain supplies and steadily rising prices have seriously hampered the introduction of improved implements, and as the rise in price is largely due to the increased cost of raw matarials, it is impossible at present to see what future prices will be. In spite of this progress has been considerable, nine hundred and forty-nine implements were supplied from Cawnpore either direct or through local farms and 50 from Atarra. For the coming year prospects of adequate implement supplies are somewhat better. Nine hundred and sixteen spare parts for various implements were supplied, plough parts predominating.

Seed supply.—The various departmental seed stores issued 32,101 *maunds* of seed (excluding sugarcane sets) the principal issues apart from wheat being cotton seed (2,336 *maunds*), juar and early arhar.

Agricultural shows.—No large district exhibitions were considered desirable during the year. Four small local shows were held to which exhibits of crops and implements were sent.

Receipts.—The circle receipts for the financial year ending March 31st, 1919, aggregated Rs. 28,167 as compared to Rs. 22,282 for the previous year, of which Seed and Demonstration Farms contributed Rs. 17,534.

Publications.—A bulletin describing the selection work on Cawnpore-American cotton has been accepted for publication in the Pusa bulletin series and is expected shortly from the Press. A second bulletin dealing with further work and with pure line selections from Bundelkhand cottons is now in preparation. New pamphlets have been issued on agricultural implements (Part II) and manures. The existing cultivators' leaflets on American cotton growing and potato storage have been revised and brought up to date. A number of articles were contributed to the United Provinces War Journal on agricultural matters during the year.

Experimental work.—The testing of the pure races of Cawnpore-American cotton has been continued, and one of these which has been favourably reported on by the trade, C. A. 9, which is agriculturally one of the best was grown on as large a scale as possible for seed supply and is now undergoing a practical spinning and weaving trial in Lancashire. Results of the test are not yet to hand, but a preliminary report shows that the cotton has spun satisfactorily 28 's and 30 's warps at Blackburn. As a result of an intensely dry season the staple is shorter than in 1917-18 and in an average year still better results may be expected.

J. N. 1.—The Bundelkhand selection referred to in last year's report has again yielded well and all the pure seed available was sown at the Central Seed Farm for multiplication. A spinning and weaving trial with this cotton at the Cawnpore Cotton Mills showed that it was extremely suitable to Cawnpore requirements. This cotton was reported to be superior to the best Kulpahar and Kalpi cottons and 18 's warps and 20's wefts were successfully spun and woven. This cotton is now being actively introduced in the Jalaun district and is being tested for agricultural suitability elsewhere also.

The above results appear to indicate that in two instances marked success has been obtained by pure line selection from existing cottons. In one case an acclimatised exotic has been dealt with, in another a pure line selection of considerable value has been obtained from a survey of some of the best Bundelkhand cottons. But it is perhaps desirable to point out that in the second case the selection was made from a mixed crop already recognised commercially as considerably superior to the bulk of the cottons of the province and that, since by this method all that can be hoped for is to isolate the best existing race, the scope for improvement is definitely limited. Nor does it necessarily follow that equally favourable results can be obtained in other tracts.

Some new hybrid wheats from Pusa are being tested at Kalianpur and Cawnpore Farms in collaboration with Mr. and Mrs. Howard. These trials will be continued as also a set of experiments designed to elucidate the effect of varying amount of irrigation water and different systems of tillage on the yield and quality of wheat. Little progress was possible with the latter this year owing to abnormal conditions and short canal supply.

A series of trials of different varieties of gram received from Mr. and Mrs. Howard have yielded results of considerable interest and these trials will be continued on several farms. Considerable quantities of some of these grams have been tentatively issued to selected growers with satisfactory results.

A number of other rotation and cultivation experiments are in progress on the various farms, details of which are given in the experiment station reports.

Correspondence.—The number of letters received was 4,869, issues 6,048. General agricultural enquiries, apart from those dealt with through touring assistants, numbered 1,156.

APPENDIX III.

Report on the administration of the Eastern Circle of the Agricultural department, United Provinces, for 1918-19, *by* MR. L. C. SHARMA, M.R.A.C., P.A.S.I., *Bar.-at-Law, Deputy Director of Agriculture.*

1. Eastern Circle consists of 12 districts, viz., Fyzabad, Bara Banki, Lucknow, Rae Bareli, Sultanpur, Partabgarh, Mirzapur, Benares, Ghazipur, Ballia, Azamgarh and Jaunpur. The head quarter is at Partabgarh.

2. *Staff.*—I held the charge of the Eastern Circle throughout the year. Babu Brij Lal acted as Divisional Superintendent of this circle from 28th August, 1918, up to the end of the year.

3. *Work.*—The work of the circle done during the year under report may be classified as follows :—

I.—Experimental investigations.
II.—Organisation of District Demonstration Farms and field Demonstrations.
III.—General supervision of most of the private farms.
IV.—Seed Dépôts and Seed Farms.
V.—Miscellaneous work.

I.—Experimental investigations.

The work of experimental investigations is conducted chiefly at the Partabgarh and Benares agricultural stations, and the necessary details of this work, together with results obtained will be found in the combined reports of the said stations for the year 1918-19. A brief mention of some of the more useful results so far obtained will not, however, be out of place here.

(*a*) *Varietal experiments.*—As a result of these experiments, it has been well ascertained that Pusa 12 wheat, Ballia and Rewari varieties of barley, Jaunpur Maize, Japanese groundnuts and large Sultanpur and long marrow fat varieties of Peas are best suited for the locality. These are being distributed to replace the local inferior ones of their own kind until some still superior varieties are discovered. Among the thick sugarcane varieties Lalgainda of Gorakhpur, Faizullahganj Ponda of Lucknow, Mauritius no. 16 and Ashy Mauritius have again stood best. B. 208 which stood first last year could not resist the dry season of this year so well as the abovementioned varieties. Among the thin varieties Reora of Benares, Saretha of Muzaffarnagar and Matna of Lakermandi appear to be better suited for the locality. Three new varieties of medium canes obtained from Shahjahanpur have been put on large areas and are doing exceedingly well.

(*b*) *Paddy—Varietal.*—There are 5 early and 12 late varieties of paddy under trial on the Partabgarh Farm. Bansphul of Bengal and Bansmati of Dehra Dun have again given the highest outturns, i.e., 1,944 lbs. and 1,416 lbs. per acre, respectively, the former giving a net profit of Rs. 99-11-0 and the latter Rs. 65-5-2. Manurial experiments with Hansraj variety of paddy show that an application of 5 maunds. bonemeal or that of 9 maunds. neem cake per acre will double the outturn of rice.

(*c*) *Dofasli rotations,* i.e., *two crops in rotation in the same year.*—Potatoes after Jaunpur maize gave a net profit of Rs. 81-11-6, while peas after juar and guar Rs. 88-0-8 per acre.

(*d*) *Cotton.*—Very little of cotton is grown in this circle, and that too of a very inferior quality. The Mirzapur canal system has created a great facility for growing superior cotton on large scales and 2 varieties, (i.e., 1 C. American, 2 Jn no. 1) are under trial on 40 acres in three farms. The germination in every case was satisfactory, and in spite of very unfavourable climatic conditions the condition of the crops is hopeful. There is already a spinning mill at Mirzapur and the owner is ready to purchase any cotton that may be grown in Mirzapur.

(*e*) *Poppy.*—A new variety of poppy seed received from Mr. Leake was tried on the Partabgarh Farm on 3/10 acre plot. It gave 12 seers 1 chatak opium and 5 maunds 26 seers 10 chataks seed per acre. The cultivation of the plot was in no ways superior to that given in a cultivator's field. These outturns are considered very satisfactory by the cultivators, but the main point about this variety is that it is rich in morphine.

(*f*) *Reclamation of ravine land.*—With a view of reclaiming ravine land and checking further erosion about 10 acres of typical ravine land was taken from Raja Partab Bahadur Singh of Fort Partabgarh on 12 years' lease free of rent at Chilbila, district Partabgarh. The following methods were tried which show quite clearly that large tracts of ravine lands can be reclaimed without much trouble and expenditure :—

(1) By making bandhs in suitable places with escapes to protect them and growing sarpat grass at the lower end to prevent soil being washed away. The intensity of the flow may be greatly decreased by opening up the soil on the sides and keeping it under grass.

Silt deposited from 1907-1917 measures 11 inches to 30 inches. Gram, barley, early arhar and groundnuts are now successfully grown in fields so reclaimed.

(2) Growing fruit and timber trees where the embanked area was very uneven and the erosion was most marked. Seventeen mango and five Mohwa plants were planted in 1915-16 after the deep *thala* system. They are all doing well and will bear fruits in two or three years. These methods are being copied in the neighbourhood.

(g) *Reclamation of usar land.*—One of the objects with which the land was taken for Partabgarh was to experiment in the reclamation of usar land. By deep ploughing, drainage and manuring the soil has so far improved and that there are now little evidences of salt impregnation.

In 1917-18 wheat grain yield of 1,080 lbs. per acre was obtained from this land and in the year under report yield of 1,490 lbs. was obtained from the same area.

Raja of Amethi had kindly given to the department 10 bighas of typical *usar* land at Sarwanpur about 2 furlongs from Amethi in 1907 free of rent. We have been growing crops in half the area with good results, while the other half which was put under timber and fruit plants has now fairly good trees growing over it, most of which will bear fruits within a year or two. The area taken from the Raja will be returned to him before December next. All this has encouraged the Raja Sahib who was pleased to give to the department another typical *usar* land about one hundred acres in area at Muswapur free of rent and the *usar* reclamation experiments are being conducted on larger scales thereon since last year. About 30 acres deep ploughing was done with a tractor which the Director has recently secured for this circle in order to achieve better results in the shortest possible time.

(h) *Eradication of deep-rooted Grasses.*—Thousands of acres in the districts of Ballia, Benares, Partabgarh and Jaunpur have been covered with Roshna weed (*Pluchea Lanceolata*) within the last 50 years, and the fact that it is spreading so very quickly on the cultivated area shows that a large area of cultivated land will be rendered useless by it every year in the said districts if the question of eradication thereof is not promptly taken up.

This weed is quite different from Kans and thrives better on light soils and in hot weather. Its roots and runners go deep into the soil and spread side-ways forming a sort of net-work. Its seeds which ripen before rains are often carried by rain water to long distances where they germinate and the weed soon begins spreading.

The land was deeply ploughed in the months of March, April or May and again at the beginning of the rainy season. The roots and runners turned over were either collected by using a harrow twice or thrice or picked out by piece labour after each ploughing and burnt on the spot. Demonstrations of the value of a tractor plough for eradicating deep rooted weeds have been given at Lucknow for the benefit of landlords visiting that city. There seems little doubt as to its efficacy and the extended use of such machinery might lead to the reclamation of much land infested with weeds.

II.—Organization of District Demonstration Farms and Field Demonstration.

There are now 12 Demonstration farms in this circle. They were started on leased lands three years ago (in some cases four with a view of (1) familiarising the interested zamindars and cultivators of the various districts with the up-to-date practical agriculture, such as better methods of cultivation, cake manures, and the application thereof, best methods of sowing improved seeds and growing crops, the use of improved implements, cultivators, harrows, hand-hoe, the reclamation of *usar* land, etc., and (2) demonstrating on larger scales what proved profitable or economical on the Government experimental station chiefly of this circle.

Small temporary farms proved of immense value so far in creating the demand for improved seeds, cake manures, pumping plants, other machines and implements on one hand and supplying all such demands at the cheapest possible price on the other. The growth of private farms renders the increase in the number of these small farms unnecessary, and what is now desirable is the introduction of machinery to run these farms on up-to-date lines.

III.—General supervision of most of the private farms.

There are now 54 private farms in this circle as compared with 48 in the previous year, not counting those that are less than 15 acres. A good many of these farms have been enlarged to over 100 acres and some of them are now fairly organised, hence supervised by the owners themselves directly, under our advice. Most of these private or taluqdar farms are doing a most useful work by way of (1) introducing the improved seeds to the tenants of the estates, (2) maintaining purity of seed, (3) giving demonstrations by using cake manures and improved implements and (4) familiarising the neighbouring taluqdars with better crops and much higher out-turns. An indent for Pusa 12 wheat seed worth Rs. 10,000 was received from the Agricultural department, Bihar, and I am glad to mention here that the Hon'ble Sir Raja Rampal Singh's farm could supply us nearly Rs. 5,000 worth Pusa 12 of good quality after meeting the requirements of the tenants of the estate. Sirdar Nibal Singh and Thakur Jagannath Bax Singh could also conveniently sell us Pusa 12 for about Rs. 5,000 from the fresh produce of their farms.

Some owners of the private farms have very kindly supplied me detailed reports of their respective farms which show splendid success and large profits for the year, and a brief mention of them here below may be of some value to those who intend to open farms.

(1) *Kurri Sidhauli Farm*;—This farm has been extended to over 100 acres during the year under report. Pusa 12 wheat was chiefly grown and a few selected varieties of paddy and sugarcane crops. A great difficulty was experienced for irrigating such a large area under wheat which was overcome by getting the well bored and putting up a pumping plant lent by the department. It is highly satisfactory to note that the farm made a net profit of 21 per cent. on the capital investment. This farm belongs to the Hon'ble Sir Raja Rampal Singh, K. C. I. E., and was visited by His Honour the Lieutenant-Governor of these Provinces. This farm was able to supply nearly Rs. 5,000 worth Pusa 12 wheat to the Agricultural department, Bihar, after meeting the requirements of tenants of the estate. The Raja

takes a very keen interest in all agricultural matters and has opened a large paddy farm during the year under report.

(2) *Chandapur Farm*.—It belongs to the Hon'ble Raja Chandra Chur Singh of Chandapur and is worked by a competent man under the direct snpervision of the Raja. This farm grows best crops of thick sugarcanes besides Pusa 12 wheat and paddy crops. It is well known for its intensive cultivation and dofasli rotations, such as Pusa 12 wheat after early paddy. The farm made a net profit of 55 per cent. on the total investment. A large seed dépôt is also attached to the farm that is doing a very useful work in spreading the improved seeds throughout the Raja's estate.

(3) *Undawa Farm*.—It is 61 acres in area and belongs to Sirdar Nihal Singh, Esq., Bar.-at-Law, Taluqdar of Rae Bareli district. It is irrigated from a tank and grows fine crops of wheat and paddy. It is highly satisfactory to note that the farm gave a net profit of 35 per cent. on the total investment for this year which is the very first year of its starting.

(4 and 5). *Parera and Akbarpur Farms*:—The former is 145 acres and the latter about 30 only. Both of them belong to Sirdar Nihal Singh, Bar.-at-Law, and were opened during the year under report. The former is about 15 miles from Rae Bareli, while the latter only a mile. The sources of irrigation were very scanty but were considerably improved by boring the existing wells and on which pumping plant was installed. A very large area was put under Pusa wheat 12 on these farms. The results are highly satisfactory, and were it not for the dry weather and exhausted nature of the soil of these farms a large portion of the initial expenditure on laying them out would have been recovered this very first year. All these three farms were supervised by one of our fieldmen under the direction of the district Agricultural overseer.

(6) *Rahwan Farm*.—It was started in 1917 on a small scale, but has soon grown up to 125 acres. It belongs to Thakur Jagannath Bax Singh, Taluqdar of Rahwan estate who supervises it directly with the keenest possible interest. A good deal of difficulty was experienced in sowing Pusa 12 wheat, and though pumping plant was installed, only 31 acres could be put under wheat. The highest produce of wheat is reported to be 32 maunds per acre on this farm which gave a net profit of Rs. 145 per cent. on the investment. From the interest which Thakur Jagannath Bax Singh takes in the direct supervision of his farm, this farm promises to be one of the best in Oudh.

(7) *Brahmni Farm*.—This has been extended from 100 acres to 180 during the year under report. It belongs to Court of Wards and has a large seed dépôt attached to it. Both of them are supervised by Mr. H. C. Young, the Special Manager, Court of Wards, in the Rae Bareli district.

(8) *Fort Partabgarh Farm*.—It has been extended to 50 acres during the year under report. Pusa 12 wheat and other profitable crops were grown on this farm after improved methods of cultivation. The season being exceptionally dry, the crop suffered for want of irrigation; still the farm made a net profit of 143 per cent. A pumping plant will shortly be put up and the farm enlarged.

(9 and 10). *Isanpur and Tala Farms*.—They are 70 and 60 acres respectively and belong to Rai Bahadur, Tnakur Raghu Nath Singh, Taluqdar of Isanpur, district Partabgarh, and supervised by his son Taakur Ram Naresh Singh, who is keenly interested in agriculture. Tney have been recently opened and will shortly be in full working order.

(11) *Diamond Farm*.—It is 50 acres in area and belongs to Babu Mata Pershad, Honorary Magistrate and rais of Benares district. A seed dépôt is also attached to this farm and they both are doing a very useful work.

(12 and 13) *Bhawan and Antrora Farms*.—These are chiefly cotton farms, about 50 acres each, recently opened in Mirzapur district by Seth Madhusudan Dass, Rais, Benares. They are irrigable from the canal. The condition of the cotton crops in spite of the unfavourable weather and certain other drawbacks appears quite hopeful.

(14 and 15) *Kusha and Dhamrawan Farms*.—They are 80 acres and 150 acres respectively and belong to Raja of Amethi. They are divided into large blocks according to the physical conditions of the soil for growing early and late paddy, selected varieties of sugarcanes and Pusa 12 wheat crops. A large area for wheat was left unsown owing to the influenza epidemic and the exceptionally dry season. The Raja has two pumping plants of his own operated by our steam engine. In spite of the character of the year some fine wheat was grown.

(16) *Jang Bahadur Farm*.—It is about 50 acres in area, supervised by the Kunwar Sahib of Amethi. The land has been reclaimed from jungle and is of high fertility.

IV.—Seed Dépôts and Seed Farms.

There are now 25 Government seed dépôts, 8 district board seed dépôts, 4 Court of Wards seed-dépôts and a number of private farms seed-dépôts in this circle. With the exception of those mentioned last and one of the Court of Wards seed-dépôt, all the others are managed by the Deputy Director of Agriculture on well organised lines. Their main object is twofold:—

(1) Multiplication of improved seeds.

(2) Replacements of the local inferior varieties of grains by those that have proved more profitable.

The total quantity of improved seeds issued from the Government seed dépôts alone during the year under report was 17,538 maunds (viz. 13,338 maunds rabi and 4,200 maunds kharif) and that sold away on cash to private farms or other indentors was 5,872 maunds (viz., 5,145 rabi and 727 maunds kharif). The Government seed dépôts of this circle are financed out of the temporary advances made to the Deputy Director of Agriculture. The financial position of all the seed dépôts is highly satisfactory.

V.—Miscellaneous work.

(*a*) *Agricultural Exhibitions.*—Five agricultural shows and exhibitions were held in the districts of Bara Banki, Ballia, Benares and Mirzapur during the year under report. Samples of improved seeds and agricultural products from various seed dépôts and the farms were exhibited, lectures were given on agricultural subjects and agricultural journals and leaflets were freely distributed during the exhibition days.

(*b*) *Cake manure dépôts.*— There are five cake manure dépôts (viz., at Lucknow, Rae Bareli, Fyzabad, Partabgarh and Benares) in which castor, neem and mahwa cakes are stocked. The value of these cakes as manures is not generally known to the zamindars and cultivators of this circle. About six years ago there was no demand for them and we could get castor and neem cakes at 12 annas a maund and mahwa cake at 3 annas a maund. Taree years ago they could not be had even at double the prices. The present prices are Rs. 2-12-0 and 10 annas a maund respectively. There is no organised market for them and therefore they are not to be had in large quantities from any one town or market. So long as cattle-dung is used for fuel, these cakes are indispensable as manures, and unless some arrangement is made to create their regular supply, the prices are likely to go up still higher. Our cake dépôt manures have placed the cheapest nitrogeneous manures within the easy reach of the interested zamindars and cultivators and are doing useful work in supplying cakes to the private farms and others.

(*c*) *Boring work.*—The introduction of large private farms has created a big demand for boring work. Four boring moharrirs have been placed under me to meet the existing requirements. Five more Chaudhri wells were tried during the year under report out of which three are reported as successful. Of the 25 farm wells that were bored for working the pumping plants 23 proved successful. Forty-eight more wells of the neighbouring zamindars were also successfully bored during the year under report.

(*e*) *Monthly Agricultural Journals.*—Both the Agricultural Journals Mufid-ul-Mazarain and Kisanupkarak (in Urdu and Hindi respectively) were regularly issued every month throughout the year. The total number of articles appeared in them was 74. The circulation of both the Journals has now gone up to over 1,000.

L. C. SHARMA, M.R.A.C., P.A.S.I., BAR.-AT-LAW,
Deputy Director of Agriculture, Eastern Circle,
United Provinces.

PARTABGARH:
The 11th August, 1919.

APPENDIX IV.

Report on the Administration of the North Eastern Circle of the Agricultural department, United Provinces, for 1918-19, *by* MR. W. N. HARVEY, M.S.E.A.C., *Deputy Director of Agriculture.*

Babu Brij Lal held charge of this circle till the 21st August, 1918, when he was relieved by Munshi Naib Husain who held charge till my return from military duty on December 20th, 1918.

A small Demonstration Farm of 20 acres was started in Bahraich on 1st September, 1918.

The Balrampur Raj Demonstration Farm was handed over to the department on May 26th, 1919, for a period of two years or less to be put into proper working order.

Owing to a lack of funds the projected rice farm was not opened, but land will be acquired for this purpose shortly.

District work.

Wheat.—During the year under report 700 maunds of Pusa 12 wheat were distributed and 200 maunds of Pusa 4. Reports regarding the results obtained from these two wheats varied considerably and in some cases were not satisfactory. This can partly be attributed to the lack of seasonable rainfall, but further investigation is required before any new varieties of wheat can be distributed with confidence in this circle. Very good yields of both Pusa 12 and Pusa 4 were obtained on the Gorakhpur Farm where irrigation is possible from a tube well.

Sugarcane.—A large number of varieties of sugarcane were grown on the Gorakhpur Farm and in several cases promising results were obtained. In view of the total failure of Java 33 from Smut, and the partial failure of Ashy Mauritius, both of which gave excellent results in the first two years of their introduction, it was deemed inadvisable to issue any cane for seed until further investigation had been carried out.

Miscellaneous.

1. Maize, barley, gram, early arhar, castor, groundnuts and juar seeds were distributed in moderate quantities during the year.

2. The demand for tube wells is steadily increasing, but owing to lack of plant it cannot be met.

3. During the year forty Meston and Watts ploughs were sold to cultivators and a number of chain pumps, and chaff-cutters but owing to the high prices the demand is falling off.

4. *Correspondence.*—The total number of letters received and issued during the year was 1,796 and 865 respectively, exclusive of demi-official correspondence.

W. N. HARVEY, M.S.E.A.C.,
Deputy Director of Agriculture.

APPENDIX V.

Report on the Administration of the Agricultural College, Cawnpore, for 1918-19, *by* MR. G. CLARKE, *Principal.*

I took over charge of the Principalship of the college in addition to my own duties as Agricultural Chemist to Government from Mr. H. M. Leake on April 16th, 1919.

The post of Warden was held throughout the year by Munshi Abdul Qayum who is also Assistant to the Principal and Superintendent of the College Farm.

The Professorship of Agriculture is still vacant, and I have taken over the duties in addition to those mentioned above as a temporary measure.

Two more lecturers have been appointed to the college staff.

As the result of a reconsideration of the matter by the Governing Body, the teaching of English to the vernacular courses has been reintroduced. An English teacher has been appointed.

Final Examinations in the four years Diploma and in the two years Vernacular were held in April, 1919. The external examiners appointed by the Governing Body were:—

Agriculture.—W. Roberts, Esq., B.Sc., Principal, Agricultural College, Lyallpur.
Botany.—R. S. Hole, Esq., F.C.H., Forest Botanist.
Chemistry.—C. S. Taylor, Esq., B.A., Principal, Agricultural College, Sabour.

The following results were obtained :—

Diploma Course.

Candidates.	Passed.	Failed.
7	6	1

Vernacular Course.

Candidates.	Passed.	Failed.
22	17	5

The six diplomates have obtained employment as follows :—

Three have been taken into the Agricultural department, one has been appointed to a post in the Sugar Bureau, Imperial Department of Agriculture, Pusa, and two have been taken in the United Provinces Educational Department. The vernacular course passed students have obtained employment as follows :—Six in the United Provinces department of Agriculture and four in the service of Native States.

The admissions for the season 1919-20 are very satisfactory. The boarding houses and special quarters are both full.

An interesting development is the increasing popularity of the four years' course amongst the land-owning classes. For some years past, there have been signs of this tendency, which those in closest touch with agricultural education were able to appreciate, and those who pressed for the development of the higher work of the college have the satisfaction of seeing, in the present position of the college, full justification for the correctness of their opinions.

This year in a class of 20 in the 1st year of the diploma course 12 are landholders, sons of landholders and men of independent means who do not desire Government service and who intend to take up agriculture and the management of their estates. The revenue represented by this class is Rs. 2,20,475. The vernacular course continues to do good work amongst a class who have not obtained sufficient educational qualifications to allow them to take advantage of the higher course. Many of the applicants who seek admission to this course, however, would be more suitable for the Agricultural High Schools which are being established.

Out of a class of 22, six do not require Government service. The revenue represented by the class is Rs. 28,398. These figures show the lines on which the college is developing.

During the year under report a scheme has been prepared for the extension of the laboratories and equipment of the college which, when completed, will make the scientific side equal to that of the best British and American Agricultural Colleges. This extension includes provision for teaching and research in Plant Pathology, Plant Physiology, Entomology and Agricultural Bacteriology as well as for the much needed provision of a chemical laboratory for the advanced students.

The most pressing need now is the development of the practical agricultural side of the work. The College Farm is insufficient in size and poorly equipped with modern machinery and appliances for teaching agriculture. The post of Professor of Agriculture, one of the most important in the college, is still unfilled, owing to the difficulty of recruiting a man with the requisite qualifications.

A project is being prepared for new special quarters (for students who desire better accommodation than that provided in the ordinary college boarding houses,) an additional boarding house and dining hall.

G. CLARKE,
Principal.

Dated the 5th August, 1919.

APPENDIX VI.

Report on the administration of the Botanical Section for 1918-19, *by* MR. W. YOUNGMAN, *Officiating Economic Botanist to Government, United Provinces.*

Charge.—Mr. H. M. Leake held charge of the post of Economic Botanist to Government, United Provinces, from the commencement of the period under review up to April 16th, 1919, when he proceeded on leave. From that date I took over charge as Officiating Economic Botanist, Babu Ram Prasad holding charge of the post of Assistant Economic Botanist.

The research work on cotton and poppy has been continued on the lines indicated in previous reports. A paper on the inheritance of certain characters of the opium poppy is being prepared for the press by Mr. Leake.

Cotton.—Work on this crop occupied the major attention of the section. K 22 produced better results than in previous years, in spite of the dryness of the season which necessitated much irrigation. Some new selections of K 22 were made which are being tested for purity and tried on a larger scale.

Poppy.—Experiment on the opium poppy was continued. Improved seed of a purified race was distributed in certain districts through the co-operation of the Opium department. The pure seed derived originally from a single plant culture and last season distributed for the first time in the Rae Bareli district has now in its second season in that district produced 416 maunds for distribution. This the Opium department has allotted for next season. It promises well for good increase in the morphine yield. Some new selections as regards habit of growth and high yield of morphine are in process of purification.

Wheat.—Seed of Cawnpore 13 was supplied to the Western and Central Circles. Cawnpore 46 has been distributed and grown by some of the farms of the department.

Barley.—A collection of over six hundred samples previously selected from single plants was grown on the experimental farm. Work on the effect of moisture on stored barley was carried out.

Seed Farms.—The Kalai Seed Farm was in charge of Babu Ram Prasad until the 31st March, 1919, when it was made over to the Western Circle, the tenure of the farm by the Economic Botanist ceasing. The results from a financial point were much better this year than in previous years. The expenditure on the farm was Rs. 7,100 and the income, including the value of produce distributed to other sections of the department for which no price was charged, amounted to Rs. 16,528. (Rs. 13,500-10-0 was actually deposited in the treasury.) This gave a credit balance on the year's working of Rs. 9,428.

In October, 1918, work was started on some 158 acres of land taken up at Raya in the Muttra district. The land is situated in an area where there is probably much scope for the distribution of a better class of seed for many crops. Incidentally it will also furnish to the cultivator an opportunity to see improved methods of cultivation and agricultural machinery. It has the advantage of lying along the Mat Branch of the Down Ganges Canal, there being thus a good water supply. It is though not of the quality and heart of the Kalai soil and it will take some years before the effect of the necessary levelling that has to be done can be overcome. The land too is in a district overgrown with "banserai" (*Pluchea Lanceolata*) the extirpation of which will be another task. The laying out of the farm and the erection of the necessary buildings are in active progress. Several acres of K 22 and improved strains of American cotton have been planted and seed distribution of some of these will probably be made next year.

W. YOUNGMAN,
Officiating Economic Botanist to Government,
United Provinces.

Dated the 16th July, 1919.

APPENDIX VII.

Report on the administration of the Chemical Section for the year 1918-19, *by* MR. G. CLARKE, *Agricultural Chemist to Government, United Provinces.*

I continued in charge of the office of Agricultural Chemist to Government throughout the year. I also held charge of the Agricultural Library and the Sugarcane Research Station, Shahjahanpur.

As already stated in the report on the Agricultural College, I took over charge of the Principalship of the college from Mr. H. M. Leake, who proceeded on long leave on April 14th, 1919, and in addition, as a temporary measure, took over the current duties of Professor of Agriculture.

Mr. S. N. Chatterjee, M.Sc., demonstrator in Physics, Queen's College, Benares, has been appointed junior lecturer in Physics and joined the college on July 11th, 1919. With the exception of this change the staff remained the same as in the previous year.

The college courses are full now and the teaching of practical and theoretical courses in Chemistry and Physics continues on lines already laid down.

The large number of students has made the provision of extra laboratory accommodation for the advanced students essential and a scheme has been prepared in connection with the proposed college extensions to provide for this.

I continue to give the courses of lectures on General Chemistry to the elementary students and on Bio-chemistry in its relation to agriculture to the advanced students.

The shortage of equipment which was mentioned in last year's report has been made good by the arrival of stores from England. The increased cost of all materials required for science teaching will make some increase in grant necessary for some years.

The pressure of routine duties has not allowed much time for the initiation of new lines of research. An investigation has been started dealing with the proteins of the important Indian pulse crop, and some of these have been isolated for the first time in a pure state. Preliminary methods have been worked out for the investigation of nitrate formation and variation in Indian soil as affected by methods of cultivation.

The work at Shahjahanpur continues to make satisfactory progress. Three new varieties of canes which have been raised from cuttings imported direct to Shahjahanpur have been given out to circle farms for trial. Twenty-two seedlings received from the Sugarcane Expert, Coimbatore, have been successfully raised and will be on a field scale next year.

The methods of cultivation are being still further improved. The results have been embodied in an illustrated bulletin now in the Press.

Last year a yield of 36½ maunds of P 12 was obtained at Shahjahanpur with one irrigation after sugarcane.

Sugarcane seed was distributed to all circles and the methods of cultivation followed at Shahjahanpur explained and demonstrated to seven assistants who visited the farm. This year an assistant from the central circle is being sent for training for six months at the farm in improved methods of sugarcane cultivation.

G. CLARKE,
Agricultural Chemist to Government,
United Provinces.

APPENDIX VIII.

Report on the administration of Agricultural Engineering for 1918-19, *by* MR. F. HOWARD VICK, *M. I.M. E., Agricultural Engineer.*

General remarks.—Work has again had to be curtailed owing to my inability of getting supplies such as engines and pumps, strainers, casing and tube well pipes etc. The year has been the most difficult one during my incumbency of the position of Agricultural Engineer, as for the years during the war I had been unable to get supplies of casing pipe for boring work, whilst those purchased several years ago were beginning to be useless and worn-out. The demand for pumping installations has been as great as ever, but owing to the depleted market I have been unable to accommodate would-be purchasers. I have registered such applicants for machinery and have now a waiting list of some 500 names. I hope to deal with these cases as supplies become available but the machinery market has in nowise yet become normal.

The monsoon of 1918 was more or less a failure in the United Provinces, especially so in the western districts, and this accelerated the demand for pumping machinery. It is to be regretted that conditions were so against the carrying out of lift irrigation schemes on a scale commensurate with the demand. In consequence of the drought and the scarcity of food grains in the province every available engine and pump, old or new, was sent out in the autumn to irrigate as much wheat area as possible, some 12 pumping sets being so distributed, mostly temporary installations lifting water from rivers or *jhils*.

Boring and tube-well work.—Work has continued in this direction, but for the reasons stated above has been limited in extent.

A new form of tube well for special geological conditions, was tried at Lucknow Horticultural Gardens and has proved very successful. An engine and pump being installed to lift the water, the well was found to give ample supply for the whole area of the gardens thus taking the place of about eight ordinary *pakka* wells and doing the irrigation in a much more efficient and thorough manner.

This form of well will be used in many places in the province as it is cheaper than some other forms and the conditions in many districts are suitable for it. I am installing engines and pumps on similar tube wells at sites in Fyzabad, Meerut and Etah districts.

Another line of work for which there is great demand is the improvement of ordinary *pakka* wells resting in sand for cultivators who cannot afford big installations with engines and pumps. Such wells often will not give a constant supply of one *charsa* of water, but by boring and use of a strainer pipe I have repeatedly made them capable of yielding four to six *charsas*. As material becomes cheaper and more plentiful I hope to carry out such improvements at the rate of hundreds of wells every year.

Many sites have been inspected and conditions investigated for tube well installations in the districts of the province so that work may be carried out directly material is available in quantity. Test borings also have been made in many of these places to prove the sub-soil suitability for the tube well.

Pumping installations.—A few very successful pumping plants have been erected during the year as under:—

Muzaffarnagar.	Fatehgarh.
Meerut.	Muttra.
Bareilly.	Cawnpore.
Lucknow.	Budaun.

A number of installations also are now in hand and will be ready and capable of lifting water for irrigation at an early date.

The classes in mechanical engineering for college students have been carried on as usual throughout the year. The attendance has been very good, the students all being very eager to get knowledge of workshop practice and mechanics.

A steam engine and boiler is required so that the students may get some knowledge of the working of such power units. They have themselves asked for this addition and wish to get certificates as steam engine drivers, so that should they have steam engines on their estates they may be certificated to take charge of them.

F. HOWARD VICK, M. I. M, E.,
Agricultural Engineer to Government,
United Provinces.

CAWNPORE:
The 16th August, 1919.

APPENDIX IX.

Note on arboricultural operations during 1918-19.

Summary of work done.—The planting season was highly unfavourable throughout the provinces and the prevailing conditions re-acted in most districts on arboriculture. The mileage planted contracted from the 237 miles contemplated by the working plans to an actual length of 215 miles, and in some districts the trees planted died within the year. Drought was the main factor in producing this result, but in few cases special causes were also operative. Of the trees planted during the year 10 miles were planted by private individuals. The planting of unsuitable trees has almost ceased in the provinces, the only case of importance is the plantation of a number of siris trees on local roads in Lucknow.

Working plans.—Working plans on local roads were carried out as a rule, but in 18 districts the cause already mentioned was responsible for divergence. In one district divergence was due to a mistake in the working plan and in another for want of nursery. In two districts work was done in excess of that provided for in the working plan, mostly to make up the deficiency of past years.

Extension of avenues.—The reports received during the year show that 13 miles of "paper avenues" have been further removed from the records and 214 miles of recent plantings have been established.

Training of supervisors.—No training class of supervisors was held during the year as the number of trained candidates still exceeds the need of the district boards in the provinces.

Financial results.—The expenditure on arboricultural operations on provincial roads was Rs. 74,291 and the receipts Rs. 24,955. The net cost to Government was Rs. 49,336 against Rs. 44,734 in the previous year. The increase in expenditure was mainly due to the enhanced cost of protection necessitated by drought. The general decline in income was also the natural result of the drought. The expenditure on local roads was Rs. 1,29,500 or Rs. 6,459 more than in the preceding year. The receipt fell from Rs. 78,170 to Rs. 66,291.

REPORT

ON THE

ADMINISTRATION OF THE DEPARTMENT OF AGRICULTURE

OF THE

UNITED PROVINCES OF AGRA AND OUDH,

FOR THE YEAR ENDING 30TH JUNE 1920.

ALLAHABAD:
PRINTED BY THE SUPERINTENDENT, GOVERNMENT PRESS, UNITED PROVINCES,
1920.

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REPORT

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ADMINISTRATION OF THE DEPARTMENT OF AGRICULTURE

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UNITED PROVINCES OF AGRA AND OUDH,

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1920.

(Prescribed maximum limit of the report, 20 pages)

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Glossary of crops.

English or Vernacular names of the crops.	Botanical names equivalent to the English or Vernacular names.
1. Gram	Cicer arietinum.
2. Bajra	Pennisetun Typhoideum.
3. Paddy	Oryza Sativa.
4. Juar	Sorghum Vulgare.
5. Groundnuts	Arachis hypogæa.
6. Sann-hemp	Crotolaria Juncea.
7. Arhar	Cajanus indicus.
8. Bhusa	Straw (English).
9. Kharif	Autumn harvest.
10. Rabi	Spring harvest.
11. One seer=2 lb.	
12. One maund=82$\frac{2}{7}$lb.	
13. Kapas	Gossypium Neglectum.
14. Uk...	Saccharum Officinarum.

Report on the administration of the Department of Agriculture, United Provinces, for the year ending 30th June, 1920.

No. $\frac{1801}{460-B}$.

FROM

THE HON'BLE MR. H. M. LEAKE, M.A., F.L.S.,
DIRECTOR, DEPARTMENT OF AGRICULTURE,
UNITED PROVINCES,

To

THE CHIEF SECRETARY TO GOVERNMENT,
UNITED PROVINCES, REVENUE DEPARTMENT.

Dated Lucknow, the 4th of October, 1920.

SIR,

I HAVE the honour to submit the report on the administration of the Department of Agriculture, United Provinces, for the year ending 30th June, 1920.

CHAPTER I.

ADMINISTRATION.

Officers of the staff.

2. Mr. H. R. C. Hailey held the charge of the combined departments of Land Records and Agriculture till 26th November, 1919, when he went on privilege leave, making over charge of his duties to Rai Bahadur Pandit Sham Behari Misra, Deputy Director of Land Records, as a temporary measure. On 1st December, 1919, I relieved the latter of the charge of the department of Agriculture on my return from leave and have been holding it since that date.

Mr. G. Clarke held the post of Principal, Agricultural College, Cawnpore, in addition to that of Agricultural Chemist to Government, United Provinces, until 12th May, 1920, when his services were placed at the disposal of the Government of India to work as a member of the Indian Sugar Committee. Mr. Youngman, Assistant Economic Botanist, who during my absence on leave continued to hold the charge of the office of Economic Botanist to Government, United Provinces, took charge of the office of Principal in addition to his own duties. Pandit Tej Shankar Kochak, lecturer on Physics in the Agricultural College, Cawnpore, assumed officiating charge of the office of Agricultural Chemist to Government, United Provinces, in addition to his own duties. Babu Ram Prasada, a member of the subordinate agricultural service, attached to the Botanical laboratory, discharged the current duties of the Assistant Economic Botanist throughout the year.

Mr. P. K. Dey, who was appointed as Plant Pathologist to Government, United Provinces, by His Majesty's Secretary of State for India, assumed charge of his office on 1st March, 1920.

3. Mr. Burt returned from privilege leave on 2nd October, 1919, and took over charge of his duties as Deputy Director of Agriculture, United Provinces, and Rai Sahib Pandit Nand Kishore Sharma, who officiated for him, reverted to his substantive post of Divisional Superintendent, Central circle. Mr. A. E. Parr, on return from military duty on 5th January, 1920, joined his post as Deputy Director of Agriculture, Western circle, Aligarh, Rai Sahib Babu Ganga Prasada, the Divisional Superintendent of this circle, reverting to his original appointment. Rai Bahadur Mr. L. C. Sharma remained in charge of the Eastern circle throughout the year. Mr. Deoki Nandan, a temporary Assistant to the Imperial Agriculturist, Pusa, who was appointed Divisional Superintendent of this circle on 9th

July, 1919, held charge of his office during the year. Mr. W. N. Harvey remained in charge of the North-eastern circle up to 15th March, 1920, when he proceeded on a combined leave for eight months and eight days. Rai Sahib Babu Ganga Prasada, Divisional Superintendent of the Western circle, took charge of this office and continued to hold it till the end of the year.

4. The post of Agricultural Engineer was held by Mr. F. H. Vick throughout the year.

5. The post of Deputy Director of Agriculture in charge of cattle-breeding operations sanctioned last year was filled during the year by the appointment of Mr. C. H. Parr, who took charge of the office on 30th December, 1919.

6 Babu Mohini Mohan Lal, M.A., Deputy Collector, held charge of the office of Personal Assistant of the combined department of Land Records and Agriculture till the separation of these two departments, when he made over the charge of the office of the Agricultural Department to my Head Assistant, Saiyid Ali Sajjad, B.A.

7. Mr. Annett, Agricultural Chemist to the Government of Bengal, on special duty in these provinces in connection with the experiments on opium, took charge of his office on 30th December, 1919, on return from leave; and the services of Mr. J. N. Sen, who officiated for him, were replaced at the disposal of the Government of India.

Development of the department.

8. The year under review has been one of recuperation. The staff had suffered during the war from serious depletion in the upper grades and from an expansion in other grades incommensurate with the demands on the department arising out of the development stimulated by the high prices realised from agricultural produce. A further depletion was caused by the urgent need for recuperation, the result of cessation of leave. The demands on this head are being met and the department is gradually assuming a position in which it will be able to undertake the expanding scope of its activities.

Under the scheme sanctioned by Government a further addition of 14 has been made to the staff of the subordinate agricultural service and of 19 to the cadre of fieldmen. It would appear that the needs of the department in the matter of staff will with difficulty be met by the college.

9. During the year no new farms have been opened. The omission in this case implies no departure from the policy previously laid down, under which a farm is to be opened in each district. That policy has, on the contrary, been re-affirmed and, in some respects, expanded. Lack of staff is mainly responsible. It is of little use opening farms without adequate provision of staff. Provision in these two directions must go hand in hand. Schemes have now been worked out for co-ordinating the expansion under both heads, and it may be expected that a steady development in this direction will take place.

10. The unwieldy nature of the present four circles and the need for subdivision was referred to in the Administration Report for last year. The truth of this is beyond question and efficiency can only be attained if, concurrently with the opening of farms, a re-arrangement of circles is introduced. The scheme now approved is for the ultimate establishment of 10 circles each composed of four or five districts. The circle will, as far as possible, constitute an agricultural tract. The appointment of two additional Deputy Directors has been sanctioned, but no nominations have yet been made.

11. As there appears to be some misapprehension as to the function of the various farms, a misapprehension due in part to the terminology adopted, it will be advisable here to outline the conception underlying this farm development. Each circle will be provided with a headquarters farm. This farm primarily serves the function of an experimental farm. On it investigations bearing on the problems met with in the practice of agriculture are carried out and conclusions as to the methods best adopted for the purpose drawn. The district farms offer a field for trying the conclusions arrived at on the headquarters farm under the varying conditions of the circle; in other words, they afford an opportunity for testing the applicability of these conclusions to local conditions. They also constitute a centre on which to base the district staff—a centre at which that staff can learn approved results and at which the practical application of these results

can be demonstrated. Demonstration is, thus, only part of their function and the term demonstration farm, formerly applied to some of these farms, is a misnomer. The term district farm, which is now adopted for them, cannot lead to such misconception. In addition to the above farms which form the standard equipment of each circle, seed farms are started as and where circumstances dictate and are especially needed for the multiplication of new and improved varieties. In addition special problems requiring special investigation may necessitate the opening of special farms for the purpose. Instances occur in the case of Usar and of Ravine Reclamation. Such farms naturally form no part of the normal equipment of a circle, but are opened where the special circumstances are found.

12. During the year the recently appointed Board of Agriculture has met five times. To it have been submitted the various schemes of expansion of the department. It has also considered various appeals for financial aid and, if it has failed to make allotments up to the total of the grants placed at its disposal, it is because of difficulties in reducing the earlier schemes considered to their ultimate form in rupees, annas and pies and also of absence of facilities for procuring machinery where such constitutes an essential part of the scheme. There can be no doubt that, in time, the Board will be in a position profitably to allocate the whole of the grant placed at its disposal.

CHAPTER II.

AGRICULTURAL EDUCATION.

The Agricultural College.

13. The College continues to draw, as in the past few years, a satisfactory class of student, and the number of applications is in large excess of the possible admissions. Owing to plague the College was closed as a precautionary measure and it was impossible to hold the examinations at the usual time.

In 1917 a set of 10 special quarters was erected to accommodate students who desired accommodation superior to the free accommodation supplied. These quarters consist of a set of two rooms with separate cook-house and are provided at a rent of Rs. 8 per mensem. These quarters have proved insufficient and further quarters are urgently needed. The demand for such quarters is further proof of the class of student now desiring to enter the College. But while there is every reason for satisfaction on that account, it is essential that the instruction given should be of a standard that will prove of real practical benefit. In this direction there is much to be accomplished. The College has from the date of its re-organisation in 1914 suffered from a severe shortage of staff. Throughout that period there has been no agriculturist in charge of the agricultural side and, although the post has been sanctioned throughout that time, no appointment has yet been made. During the year the agricultural work has been supervised first by Mr. Clarke and latterly by Mr. Youngman, both of whose hands are more than full with other work. Again, the student who comes from a large estate requires to learn estate management. That, that can be adequately taught on a scattered farm of some 70 acres merely, is clearly impossible. It cannot be too strongly emphasised that there is a present demand for education of the type now imparted and that there is grave risk, if the standard be not improved, that the demand will cease. Staff and land are the two essentials urgently required. A scheme for the expansion of the farm is approved and will be adopted when funds permit, but the delay caused by the resumption of the funds allotted for the purpose is likely to have far-reaching results. It is not possible indefinitely to maintain the standard even to the minimum necessary with the present inadequate facilities.

Grant for agricultural education.

14. The extension of the College buildings under the grant made by the Government of India has not yet been commenced, though the plans are in course of preparation.

Agricultural School.

15. Since the scheme for an Agricultural School at Bulandshahr was initiated, the appearance of the Sadler report has resulted in extended schemes of educational reform. In these the School as contemplated would have no place. As a middle school it would lead nowhere. The course of instruction will fall short of that required for admission to the College at Cawnpore and it will not lead up to any purely

educational standard. Under the circumstances it has appeared desirable to reconsider the status of the School and a proposal to make the School an Intermediate College, thus leading up to the College while at the same time fitting into the general scheme of education, has been approved by the United Provinces Board of Agriculture and is now before Government. There can be little doubt that there is a vast field of utility for schools or colleges of this type from which the best students would pass to the Agricultural College, while the majority would be left at the end of their educational career well fitted to return to their estates or holdings.

Horticultural education.

16. There is at present a dearth of students in the Chaudhri and Mali classes at the Lucknow and Saharanpur gardens. At the beginning of the year there were eight youths under training in the former but the number is reduced to three, while in the latter the actual number now entertained is only 10 against 18 the sanctioned number. The causes appear to lie partly in dislike for any form of manual labour on the part of Indian youths coming straight from school and partly in rise of wages which the employers are not willing to pay for. In the Saharanpur garden there were about 97 applications for services of malis or Chaudhris of which settlement for employment of only 11 could be made.

CHAPTER III.

Research and experiments

Cotton.

17. The cotton problem is governed by the economic conditions and constitutes probably the most difficult one with which the department is faced. From two points of view the cultivator looks upon the crop as a gamble. The outturn varies enormously from year to year and is largely dependent on the monsoon. On the other hand the market fluctuates in response to conditions with which the cultivator is completely unconversant. It is not surprising therefore that his attitude is that of a gambler. He makes provision first for his more stable crops, and the amount of cotton he puts down depends very largely on subsequent considerations.

The large variations noticeable in the returns of the cultivated area from year to year, variations which are more marked in the case of the unirrigated area, forming more than 50 per cent. of the total, constitute the outward sign of this condition. Under the circumstances the crop frequently receives far from adequate cultivation and develops as best it can under these adverse conditions, There is consequently a tendency to grow 'hardy' varieties and such varieties are, unfortunately, of little value as staple cottons.

18. Joint effort is required to develop races with an improved staple suited to the various cotton tracts, to test these against the kinds now grown and to introduce them with such modification of cultural method as is desirable. On the first head work has been proceeding for some years and numerous races have been developed. On the second a more complete system of trial than has been hitherto adopted has seemed desirable, and a series of comparative tests on the chess board system has been introduced. Such trial must, however, be prolonged over a series of years before adequate information becomes available, for it may happen that one race will do best under one set of conditions, while a second will do best under another; and it becomes necessary therefore to determine which are the conditions most frequently occurring. The third point is largely a matter of demonstration, but even so the matter is not without difficulty. The cultivator is largely a man of first impressions and, should the cotton be introduced to him in a season which proves to be unfavourable, he will form a prejudice against it which may take years to live down.

19. When irrigated, the plant is established before the rains and is less open to the effects of adverse conditions. It is here that improvement will be first effected. The growth on unirrigated tracts is more precarious. Here the choice lies between any cotton and no cotton at all rather than between cotton of different relative qualities. The department has come in for much criticism in respect to its attitude towards short-staple cottons, but it is not open to doubt that cottons of this quality are preferable to none.

There have been large market fluctuations in the case of cotton during the last few years. These have added to the speculative nature of the crop and have affected different grades differently. Eliminating as far as possible the purely speculative movements, there seems to be good reason for believing that, since cost of manufacture has risen to an extent which renders the price of the raw material insignificant relative to the importance attached to it a few years, a superior class of cotton is now, and will continue to be, used where an inferior class would have sufficed formerly. The demand for staple cottons has developed and will continue to develop. Nevertheless the demand for short staple still persists and a premium is still paid for high ginning cottons of good colour regardless of staple. The question arises as to why this condition persists, and on the answer to that question to a large extent depends the Departmental policy. There can be no question that a more intimate knowledge of the markets is essential if progress is to be made on sound lines, and it is to be hoped that the provincial committees, shortly to be appointed under the Scheme outlined by the Indian Cotton Committee, will facilitate that work for which there is at present no satisfactory departmental organisation.

Sugarcane.

20. In view of the appointment of the Indian Sugar Committee, the members of which visited these Provinces in November, 1919, it is not possible to say very much on the subject of this crop. The work at Shahjahanpur has been continued and the cultivation and distribution of various canes has been carried out on the district farms. Experience has shown that the question of cane-growing is intimately bound up with the question of water. There appear to be large areas in Oudh and Bundelkhand which are eminently suited for cane if water be provided. This intimate association is well illustrated in the case of the Hardoi Farm where the yield of cane reached 1,000 maunds, the yield of *gur* 130 maunds, and the price realised Rs. 1,200 per acre.

21. With the introduction of irrigation the question becomes largely economic. Irrigation and manure permit thick canes to be grown and these the ordinary bullock mill cannot handle effectively. The questions of power-crushing and of the organization of suitable units for the economic use of such, and for the disposal of the juice are matters which require earnest attention. In the course of the year a note on improved methods of cane-cultivation by Mr. Clarke, Naib Husain, and S. C. Banarji has been issued.

22. The Nawabganj Factory was again run during the season, but as the decision to work it was received late no satisfactory results were obtained and the year's workings show a slight loss. The future of this factory is now under the consideration of the Indian Sugar Committee.

Wheat.

23. Under a system of Government advances some 30,000 maunds of wheat, mainly Pusa 12, were distributed. This, however, affords no indication of the extent to which the wheats introduced by the department are spreading and have spread. They are now found practically throughout the Provinces, having spread, after the first introduction, without special agency In certain cases they have not been accepted, notably in parts of Oudh, where the complaint is that they yield no more than the local wheats. The complaint illustrates well a condition which is not infrequently met with. A crop can only develop if all essentials for its development are present. Where conditions of cultivation are poor there is a low limit to the yield of the crop which even the best cannot exceed. As soon as conditions are improved scope is given for the better crop to develop and the difference becomes apparent. Thus we find the cultivator refusing wheats which, on the Taluqdar's farm next door, give double the cultivator's yield. The remedy lies in demonstration combined with seed-supply.

Fibre crops.

24. There appears to be a considerable opening for fibre crops and experiments are being carried out with flax, sann hemp, and jute. The former has been shown to grow well and the main problems are concerned with the retting and scutching. Hemp (*Sann*) is a crop which may do well in the conditions of the Tarai where there is little chance of attendance during growth, while there is reason to believe the Ganjar tracts stretching from Sitapur to Gorakhpur will form a good field for jute.

Poppy.

25. The work on poppy has been continued and Dr. Annett, who is to be congratulated on his Doctorate, has been placed on special duty for a further term of three years. The season was a bad one and yields low. Mr. A. F. Bryan, Assistant Opium Agent, Maharajganj, carried out an extensive distribution of seed of a robust and high morphine-yielding race in Rae Bareli. Owing to his illness the figures are not yet to hand, but it is doubtful if the results will constitute as striking a demonstration of the advantage of careful storage as in the two previous years. During the year Dr. Annett has published an article on 'the use of poppy seed cake as a cattle rood and its effect on yield of milk and composition of the butter fat' in the Journal of Agricultural Science, Volume IX, part IV for October, 1919, and jointly with myself, a note on 'Investigations concerning the production of Indian Opium for medical purposes in' the Agricultural Journal of India for March, 1920.

CHAPTER IV.

ASSISTANCE TO THE PUBLIC.

Demonstration.

26. The usefulness of practice as opposed to precept as a method of raising the standard of agriculture of the cultivator is not open to doubt. It is mainly a matter of staff, and the extent to which demonstration has been adopted is limited by that consideration. With the increased staff based on the larger number of centres which the district farms will offer, the work should progress at a greater rate in the future.

Seed and Cake depots.

27. Reference has already been made to the work of the department with regard to seed-distribution. The need for manure especially in the case of sugarcane is becoming more and more insistent, but attempts at development have been hindered by the prices to which the commoner manurial substances such as cakes rose. Details of the work of the seed and cake dépôts are given in the appendices.

Sale of implements.

28. The supply of implements is still limited and prices uncertain, and until a steadier market and a stronger supply are forthcoming little progress can be made. The demand for power plant is developing and it is for the department to obtain experience in the use of, and information as to the scope for, such implements as tractors, threshers, and so on. During the year a grant of Rs. 35,000 has been given for this purpose.

Co-operative societies.

29. With the increased demand for seed, manure, implements and so on, it is clearly impossible for the department to take on the function of universal purveyor. The time has now come when extra-departmental agency must step in. Among the agencies capable of taking over this work are the co-operative societies and attempts are being made to entrust it more and more to these societies. One of the main defects is the lack of a trained staff within the co-operative movement. The subject has been discussed recently at a joint meeting of the Co-operative and the Agricultural departments and of unofficial persons interested in the movement.

Private farms

30. These farms, especially when the owner takes a keen personal interest, afford perhaps the most promising opening for relieving the department of the mass of detailed work which the demand referred to above is creating. A well-run private farm under the personal supervision of the land-owner affords not merely a ready means for demonstration by the department, it affords a *pied à terre* and centre of interest to the owner and a basis from which he can organize assistance to his tenants, whether financial or in the matter of seed. It also affords an opportunity for experiment in large-scale farming and the use of power machinery, such as pumping and threshing plant. The private farm of 100 or 200 acres in fact constitutes the basis for the development of a really sound economic organization of agriculture on the metayer basis and such farms are worthy of every encouragement.

Agricultural Engineering.

31. The most important field of work in this direction lies in the erection of pumping installations. The value of tube wells in supplying irrigation and the vital importance of an assured water-supply to the agriculture of the Province are becoming daily more apparent. The value is not limited to insurance against famine. Large tracts of Oudh could, given the water-supply, grow sugar and that supply can only come

from wells. The value of such wells is becoming appreciated and the demand is in large excess of the supply. The Engineering Section must be largely increased if this demand is to be met, and at the same time efforts must be made to keep down the capital cost of such installations. A scheme has now been approved by Government by which it is hoped both these objects will be secured and by which, when developed, it should be possible to erect some 200 such installations per annum.

Demand is not, however, limited to pumping machinery; enquiries are being received for sugar machinery, including cane mills, threshers, tractors, and plant of every sort. It is a demand which requires careful consideration, owing to the lack of experience on the part of the indentors, if much of that supplied is not to prove ineffective.

Well-boring.

32. This section is concerned with testing sites for new wells and with the improvement of existing wells. Trial borings led to 130 successful wells out of 206 borings made, while 377 out of 524 existing wells were bored with benefit. The organization of two distinct branches of the department to deal with what are actually two aspects of the same problem, the improvement of the water-supply for irrigation, is fundamentally unsound and the scheme to which reference has been made includes the amalgamation of the well-boring in the Engineering section.

CHAPTER V.

MISCELLANEOUS.

Expenditure and receipts of the department.

33. The total expenditure of the department was Rs. 9,90,814 as compared with Rs. 10,85,020 in the previous year, showing a reduction of Rs. 94,206, which is due to the fact that no new farms could be established during the year. The receipts rose from Rs. 1,07,812 to Rs. 1,61,148.

Agricultural publications.

34. No bulletins were published during the year under report. Other English and Urdu publications by the department are detailed in appendices I and III.

I have the honour to be,

SIR,

Your most obedient servant,

H. M. LEAKE,

Director.

APPENDIX I.

Report on the Administration of the Western circle of the Agricultural department, United Provinces, for the year 19.9-20 *by* A. E. PARR, ESQ., B.Sc., PH.D.,M.A. and M.S., *Deputy Director of Agriculture.*

The circle was in charge of Rai Ganga Prasad Sahib, officiating Deputy Director, till I took over charge on the 6th January, 1920. The circle has the following agricultural stations :—

Name of district.	Where situated.	Area in acres.
Aligarh	1. Aligarh	88·24
	2. Kalai	166·38
Bareilly	3. Nawabganj	1.0 0
Agra	4. Bichpuri	109·0
Muttra	5. Jachonda	55·86
Bulandshahr	6. Bulandshahr	25·0
Saharanpur	7. Saharanpur	38·75
Muzaffarnagar	8. Muzaffarnagar ..	109·0

The experimental work done at each farm is detailed in the annual report of the Agricultural stations in the Circle Demonstration work in Budaun and Etah continued as in the previous year. Steps are being taken to carry on the demonstration work in the Etah district on a larger and a more systematic scale.

District work.

In view of the recommendations of the cotton committee no direct efforts were made to encourage the cultivation of the White-flowered cotton and its seed was, therefore, given out in small quantities only to those who were very anxious to grow it, the total amount of the seed issued being about 33 maunds.

American cotton.—The seed was not much in demand. About 80 maunds were distributed.

The previous results being discouraging, growers were not ready to sow K-22 again.

Sugarcanes.—The following statement shows the quantities supplied from each farm :—

	Maunds	
Aligarh ..	.. 304	different varieties of thick and thin canes.
Bareilly ..	.. 848	ditto ditto
Bulandshahr ..	.. 348	ditto ditto
Muzaffarnagar ..	.. 120	ditto ditto
Saharanpur ..	.. 144	ditto ditto
Muttra ..	.. 243	ditto ditto
Agra ..	.. 330	Thin (different varieties).
Machua ..	.. 187	Saretha only.
Total	.. 2,424	

Wheat.—Total wheat supplied from all agricultural stations and seed godowns in the circle aggregated 6,175 maunds, 5,231 maunds of which were Pusa 12.

Other *kharif* and *rabi* seeds such as groundnuts (about 60 maunds), maize, bajra, paddy, peas, oats, and gram were also supplied in small quantities.

Implements.—The following implements were sold from the seed and implement stock in addition to those supplied from the various farm stock for trial to private farms :—

Chainpumps	2
Cultivators	1
Watts ploughs	30
Meston ploughs	65
Turnwrest ploughs	1
Archimedian screws	13
Spring harrows	5
Leverharrows	3 pairs.
Spare shares for ploughs	141

Indents for such machines as grain kibblers and chaffcutters were referred to firms for supplying direct.

Pumping installations.—All repairs to the engines in existence in the circle were properly attended to, and spare parts were also supplied as far as possible. Owing to considerable difficulty experienced by engine-owners in obtaining oil, arrangements were made to stock a sufficient quantity of kerosene oil at Bulandshahr farm, the most convenient place for the purpose, for supply at cost price to them.

Agricultural shows.—Agricultural exhibitions were held by the department along with the annual district fairs in Saharanpur, Muzaffarnagar, Meerut, Bulandshahr, and Aligarh, where various kinds of improved seeds and agricultural implements and machinery were demonstrated and leaflets dealing with improved methods of cultivation and allied subjects were distributed to the visitors interested in Agriculture

Agricultural publications.—The following articles were contributed to the various gazettes and the U. P. Journal :—

1. Agricultural improvements." Wheat Pusa 12."
2. Ditto ditto " Sugarcanes ",

3. Steam ploughing in Tarai and Bhabar Estates at Kichha.
4. The Lever harrow and its advantages.
5. Dodder (Amrbel).
6. An agricultural pest and its remedy.
7. Purity of seed.
8. Results of swelling seed in water.
9. Food for bullocks and the right way of feeding.
10. Cactus as fodder.
11. Agricultural talks on sowing, hoeing, and weeding.
12. Advantages of sowing maize with nai.

A pamphlet on trench-making for sugarcanes in English, Urdu, and Hindi and a leaflet on the advantages of sowing maize with nai were also published for free distribution among the persons interested in the subject in addition to those published previously and stocked for free distribution.

Private farms.—The following private farms are run by zamindars and *raises* with the help and advice of the department :—

1. Singhal farm, Itora, district Agra, by Mr. Adi Ram Singhal.
2. Sikandra farm ditto M. Amir Ahmad Khan.
3. Nainana Jat farm ditto M. Amba Prasad.
4. Piwari farm district Etah, by Kr. Madhau Singh.
5. Kason ditto Bohra Jamuna Das.
6. Meerut farm district Meerut, by K. B. Sheikh Wahid-ud-din.
7. Jansath, district Muzaffarnagar, by Saiyed Abdullah Khan, rais and Honorary Magistrate.
8. Mahmudpur, district Aligarh by Th. Niranjan Singh.
9. Machua ditto Th. Udho Singh.
10. Khandeha ditto B. Gopi Lal.
11. Khair ditto Pt. Shiva Charan Lal, B.A.
12. Khair ditto Pt. Lokhman Das Pachauri, B.A., LL.B.
13. Pootry farm, district Meerut by M. Abdul Majid Khan.

A. E. PARR,

Deputy Director of Agriculture, Western Circle,

United Provinces.

APPENDIX II.

Report on the administration of the Central circle of the Department of Agriculture, United Provinces, for the year 1919-20, *by* MR. B. C. BURT, B.Sc., M.B.E., *Deputy Director of Agriculture.*

Staff.—Rai Saheb Nand Kishore Sharma officiated as Deputy Director during my absence on privilege leave until October 3rd, 1919. From that date I held charge of the circle. Two students from the two-year vernacular course of the Agricultural College were appointed to the Subordinate Agricultural Service in this circle during the year. I regret to have to report that one of these, Babu Tara Datt, died recently from disease probably contracted on field service (Salonika). A nett addition of seven fieldmen was made to the cadre during the year.

It cannot be too plainly stated that further progress is largely a matter of staff of all grades. The unwieldy size of the circle has been recognised since 1912 and proposals for its sub-division approved but action delayed owing to the war. Subordinate staff is quite inadequate, particularly in the upper grades and consequently three important districts are without any agricultural staff, whilst in others, comparatively junior men are working singlehanded. Similarly of the three divisions. which constitute the circle, only one possesses a Divisional Superintendent. Non-graduate fieldmen have been employed where possible to mitigate the shortage of staff, chiefly on district and seed farms. But until the staff is radically revised it will remain impossible to deal with all the applications for assistance received or adequately to deal with village demonstration work.

Tours.—I attended the Board of Agriculture (India) at Pusa in December and the Nagpur Motor Tractor trials in February. My cold weather tour, apart from farm inspections, was spent in Unao, Hardoi, and Sitapur districts. In the latter district there is a rapidly-growing demand from taluqdars and zamindars for assistance in respect to home farms which it is only possible to meet partly with our present staff.

Farms.—No new farms were opened during the year under report. The old Mainpuri farm on rented land was closed and the land returned to the previous tenants. The buildings and laying-out of the new farm were completed during the year and the farm is now fully equipped except for a tube well under construction. During the coming year a new district farm will be started in district Allahabad.

District work.

Wheat.—The systematic introduction of Pusa 12 and Pusa 4 wheats was continued; the former in the Oudh and *Doab* portions of the circle, the latter chiefly in Bundelkhand. Issues of wheat seed from stores controlled by the department aggregated 23,389 maunds (about 31,000 bushels). While this represents a large increase on previous years, it is no measure of the rate at which these wheats are extending as natural extension is very considerable. The re-purchase of wheat from cultivators and private farms and its distribution takes up far too large a proportion of the time of the subordinate staff and general demonstration work is restricted in consequence. It is hoped that in some districts some of this work will be taken over by co-operative organizations in the near future. In two districts, viz., Etawah and Hardoi, the District Boards have taken up seed-storage and this will afford some relief to the department in time during the first year all work is being supervised by our staff.

By concentrating effort the number of villages growing practically no other wheat is now increasing steadily and these act as centres of purity and as centres for natural extension. Once the initial demonstration and introduction stages are over, it is necessary to re-stock such villages at least once with new seed from our own farms if mixture is to be avoided. An increasing number of zamindars are also growing considerable areas of this wheat on their own land and in this way a network of local seed farms is gradually being built up.

In Bundelkhand Pusa 4 wheat has been again a marked success on the Ken Dhasan and Betwa Canals and we are again greatly indebted to the Canal staff for much assistance in seed-distribution. In this division the demand for seed is large and progress is only limited by the amount of seed which our staff can handle. The bulk of the seed is given on *taqavi* and the Commissioner of the division has this year approved a simplified procedure which will reduce considerably the labour of dealing with these applications.

Cawnpore 13 wheat has again been issued for limited areas in Banda district.

These wheats fetch a high premium in the local markets for export to Bombay, but unfortunately are usually exported mixed with 30 to 50 per cent. of local *desi* wheat.

For the unirrigated black-soil area small quantities of Soharia wheat have been issued as it is less liable to rust than Kathia. We have no wheat at present that has been a marked success in this area which appears to be essentially a Durum wheat tract.

Cotton.—The extension of Cawnpore-American cotton was continued and, as in the previous year, special selected channels were guaranteed by the Canal department to ensure adequate water for timely sowing. The final area reported was 8,100 acres and the outturn estimated at 3,500 bales, as compared to 4,700 acres in the previous year. Arrangements for bringing this cotton on the open market were made and departmental purchase discontinued. A Cawnpore firm of ginners undertook to purchase all American *kapas* offered at a guaranteed minimum premium of Rs. 2 per maund of *kapas*, the actual premium being governed by Bombay market prices. This arrangement was in force at four ginning factories and one other buying centre. Approximately half the crop was handled in this way, cultivators and middlemen were left free to sell where they chose and most of the rest of the crop was traced to other ginners and buyers in Cawnpore and was bought as American and not mixed with *desi*.

The department retained first claim on all the seed required and our staff were at liberty to inspect *kapas* as it arrived in the ginning factories of the firm with whom arrangements were made and to set aside special lots for seed. On the whole, the arrangement worked well. The larger growers took their cotton direct to the ginning factories and the prices they received were on the whole higher than would have been possible under departmental arrangements. Many small growers sold through middlemen and their *kapas* was distinctly mixed in some cases, though rarely to such an extent as to materially affect the commercial value of the lint. A few cases of deliberate mixing were detected and in this case the whole consignment was refused. Special steps were taken to ensure the purity of the seed for distribution both by roguing fields and ginning this *kapas* separately and by subsequent cleaning.

The ordinary Cawnpore American is now being steadily replaced by the selection C. A. 9 which is the best of the races isolated. Seed for some 2,000 acres of this selection is being issued for *kharif* 1920 and this has been concentrated in a small area where supervision is possible and special buying arrangements made.

*J.N.*1.—This selection from the Bundelkhand cottons was grown on a large scale for seed-production at the Kalianpur farm and was distributed on a small scale in Banda and Hamirpur districts and on a larger scale in the north of Jalaun. The season in Bundelkhand was unfavourable for all cottons and there was only a limited supply of canal water. In consequence, and also partly owing to the seed-distribution being muddled during my absence on leave, no commercial quantity of this cotton was available this year. Seed for some 1,000 acres is now being distributed. The uncertain nature of the canal supplies for early *kharif* imposes a severe limitation on the development of cotton-growing in Bundelkhand.

K 22 *Cotton.*—Further district trials with this cotton in Hardoi and Unao districts were carried out. Some quite good yields were obtained by individual cultivators, but on the whole the results were somewhat unfavourable as this cotton did not stand prolonged rain well and was late in maturing.

Sugarcane.—As in previous years, practically all the cane grown at the various farms was readily taken up for planting. Organized demonstrations of the proper methods of cultivation for improved varieties have been started in the Sitapur district on the Kaiesar Estate, where the irrigation supply is guaranteed by two tube wells. Given an assured water-supply it is probable that cane-growing in Sitapur and parts of Hardoi can be revolutionized.

Considerable progress has also been made with the extension of sugarcane cultivation on the Majhgawan Tank area, district Hamirpur, and with the distribution of better varieties around Rath, in the same district, where cane cultivation was established even before the construction of the Dhasan Canal.

There are large areas on both the Ken and Dhasan Canals suitable for sugarcane and the yields at the Atara Farm, where canal irrigation is supplemented by wells, compare favourably with any part of the province. But until these canals can give regular hot weather supplies, it is not possible to actively encourage cane growing except in special areas.

Rice.—Transplanting of rice is spreading steadily in parts of Banda, the area of transplanted rice in that district for 1918 *kharif* being 3,817 acres of which 3,599 was in Baberu pargana and in 1919 *kharif* over 5,000 acres. Shortage of labour, however, militates against the more rapid spread of this practice the local value of which has been clearly shown by several years' experiment at Atarra.

Other crops.—Considerable quantities of seed of two selected varieties of *juar* (270 maunds), of Jaunpur maize (83½ maunds), of Unao early arhar (53½ maunds) awned Bajra (13½ maunds) selected grams (556½ maunds) and Pusa 28 tobacco have been distributed during the year. More could have been done with greater facilities for growing seed of some of these crops but, on the other hand, the seed rates are low and the quantities handled are naturally much less. Further these are crops for which cultivators usually keep their own seed.

Tentative distribution has also been started of some Pusa grams which have yielded consistently well at our farms.

General Demonstration Work.

Improved methods of cultivation and the correct methods of growing crops necessitate more thorough and painstaking demonstration than the introduction of improved varieties of crops. Since such methods also call in many cases for the use of new, and often relatively expensive, implements, it is clear that progress is not likely to be so rapid or so general. But the increase in yield obtainable is often far greater and, so far as limits of staff permit, increased attention has been paid to this side of agricultural development. There are now 22 touring assistants in the circle carrying out village demonstrations and, so far as possible, trained labourers have been lent them from the farms to assist in these demonstrations and to enable the number to be increased. In this respect private farms are of very great value. Proposals have now been submitted for a special staff of trained labourers for this class of work.

The principal demonstrations have been green manuring for wheat, harrowing of wheat after the first irrigation to economise water, the use of the ridger * for making irrigation

* In co-operation with Canal officers an attempt was made to encourage the making of proper irrigation *kiaris* to reduce the waste of water which occurs at present. The use of the Aligarh ridge-maker to reduce the labour involved was demonstrated on 750 acres in the Bundelkhand Irrigation Circle.

kiaris: the use of castor and *mahwa* cakes as manures, drill sowing of cotton, interculture of cotton, hot weather ploughing for wheat, correct use of iron ploughs, improved methods of *gur*-making and the use of iron sugarcane mills.

The introduction of improved implements has been considerably hampered by short supplies and variable prices, but as conditions settle down there is evidence that there will be a considerable demand as the rapid rise in the price of bullocks and labour has given a considerable impetus to their use.

Seed and demonstration farms.—With the exception of a small area of broken land the whole of the extension of the Kalianpur seed farm has now been brought into regular cropping. The working expenses of the year were Rs. 15,470 and receipts Rs. 20,382. The expenditure includes a considerable amount for experimental work which could not be undertaken at the experimental farm proper for want of land. The equipment of the farm has been improved by the erection of a small ginning factory which was much needed.

The Etawah district farm was maintained as in previous years partly for seed-growing and demonstration and partly for local experiment, particularly variety-testing. The receipts were Rs. 8,112 and the working expenses Rs. 3,862.

The Hardoi district farm (40 acres) as before was run in co-operation with the District Board the department providing and controlling the supervising staff and the Board meeting the working expenses and taking all receipts. Despite some considerable expenditure of an unusual nature the farm paid a gross profit of Rs. 2,359. The land has now been acquired by Government. The tube well, provided in 1918, has again proved of the greatest value and has not only provided a perfect irrigation-supply for the farm but has also irrigated 83 acres for neighbouring cultivators.

The new Mainpuri farm is now complete except for the tube well and is cropped as fully as the present irrigation-supply permits. This farm is situated on very light land and is intended largely as a demonstration as to what can be done with land of this character under tube-well irrigation.

Court of Wards estates.—Demonstration and seed farms are maintained by three Court of Wards estates, viz., the Harchandpur estate in district Etawah, the Rampura estate in Jalaun and the Katesar estate in district Sitapur. The Harchandpur farm of approximately 45 acres during the last working year after paying rent Rs. 675, returned a profit of Rs. 3,685, of which Rs. 800 was seed-storage profits and the balance Rs. 2,885, farming profits. This farm occupies an excellent piece of *sir* land and now that the initial expense of getting the land level and in order has been met, should continue to prove an excellent investment to the estate as well as a most useful centre for demonstration work and seed-supply. The seed store building has recently been completed and it is hoped to develop further the seed-distribution scheme which has been in progress for some years.

The Rampura farm occupies approximately 100 acres of land on the Kathaund Branch of the Betwa Canal and forms a most useful centre for pure seed of J. N. 1 cotton, Pusa 4 wheat and early *arhar*, all of which are being actively distributed in the estate. There is room for considerable improvement in the management of this farm.

The Katesar estate has been running a most successful seed store for some years and organized demonstrations are now in progress on the tube-well areas. A small demonstration farm at Nabinagar has been laid out on one tube-well area on which demonstrations of the correct methods of growing improved canes are in progress with new canes from the Shahjahanpur Research Farm. Other crops are Pusa 12 wheat chiefly for seed-supply, J. N. 1 cotton for trial in this area, lucerne, gram varieties, and early *arhar*.

Even more important at present than the farm itself are demonstrations on the tube-well areas on tenants' own land. The seed store includes a dépôt for agricultural implements and for oil-cakes for manures Unless the installation of tube wells in such areas can be followed up by demonstrations of the improved methods of cultivation which are made possible, the optimum results will not be achieved. The soils are light and capable of yielding excellent crops under irrigation but attention to levelling, correct cultivation, and manuring is essential.

A tour with the Special Manager in the *ganjar* tract of this estate, which is typical of much of that portion of the district, was made during the last cold weather. A series of experiments on rented fields with jute, referred to in detail elsewhere, has been started and also with some real deep water rices which may prove profitable in the flooded portion of this tract. The tract as a whole is precarious particularly in wet years but several improvements are possible and these are being taken up. I particularly wish to acknowledge again the valuable assistance received from Mr. Dunne in connection with agricultural improvements in the Sitapur district. Much interest is now being shown by various Taluqdars in the district in agricultural development and the work at Katesar has paved the way for a general advance.

For the Court of Wards' farms mentioned above trained fieldmen have been lent by the department.

Private farms.—The three farms in Court of Wards estates have already been mentioned. Reference was made in last year's report to the growing tendency of zamindars to cultivate their *sir* or *khudkasht* as home farms and the demand for assistance from the department in obtaining compact blocks and as to improved methods. In Cawnpore district Babu Narayan Prasad (*Kurmi*) has continued to run his 40-acre compact farm, referred to in previous reports, and this has continued to be a model to his neighbours and of great assistance to us in local

demonstration work. A similar farm of slightly smaller area has recently been started in village Umariya. At Sachendi Lala Lachmi Narayan Agarwal has a farm of about 100 acres for the management of which the department has lent a trained fieldman (on payment).

In Etawah district a number of zamindars are cultivating *sir* under our advice, compact farms are being managed on modern lines in two villages, by Rao Nar Singh Rao and a 40-acre farm has been started by the Rajah of Partabner, both of which will be of considerable help in demonstration work.

In Mainpuri district 20 areas of *sir* land varying from 10 to 50 acres (9 compact areas) are being worked by their owners under our advice.

In Fatehpur district Lala Adya Saran Singh runs a farm of 80 acres, chiefly for wheat and cotton at Jahanabad.

In Allahabad district the Rajah of Baraon has maintained his home farm at Baraon. In Banda district two private farms at Khurhand and Naraini have given material assistance in respect to seed supply.

The following table though known to be incomplete gives further information as to organized demonstrations on zamindars' *sir*. The number of zamindars cultivating *sir* and growing various crops recommended by the department is very much larger, but an attempt has been made to record some of the more important cases where work has been in progress for some time. Such areas are of material value in connection with seed-supply and the demonstration of improved agricultural methods. It has not been attempted to include all districts in the circle in this return, but better statistics will be available in future years :—

Farms and Demonstration Areas on sir Land.

District.	Situation.	Owner.	Area acres.	Remarks.
Cawnpore ..	Macha	Babu Narayan Prasad..	40	Compact farm, well equipped. Principal crops Pusa wheat, American cotton.
	Umariya	M. Shah Beg ..	25	Recently started, compact area, following same lines as Macha.
	Sachendi	Lala Lachhmi Narayan Agarwal.	100	Recently started, grows a large area of Pusa 12 wheat, well equipped with implements, not compact.
	Mandhana	Pandit Bindeshwar Misra.	50	Zamindar's *sir*, not compact, has carried out demonstrations for several years and uses a number of modern implements.
	Bilahripur	M. Mohammad Husain	17	*Sir* land, green-manuring, Cawnpore American cotton, Pusa 12 wheat and other crops.
	Patara	Thakur Makund Singh and Thakur Bhajan Singh.	40	Wheat, cotton and tobacco, ploughs. Zamindar's *sir*.
	Kanhra	Ch. Putiyan Singh ..	50	Wheat and cotton chiefly, also sugarcane and other crops. Well equipped with implements. Grew 26 acres pure seed for seed-supply.
	Kathaura	Thakur Ajodhia Singh and Govind Singh	50	Wheat, cotton, ploughs, *sir* land.
	Kudni	Ch. Debi Singh ..	10	*Sir* land, 9 acres improved crops.
Fatehpur ..	Jahanabad	Lala Adya Saran Singh	80	Compact farm. Pusa 12 wheat and Cawnpore American cotton principal crops.
Ditto ..	Deopura	Ch. Mata Din ..	10	Occupancy tenant, general demonstration.
	Makrali	Pandit Gobind Prasad	12	Ditto.
	Fatehpur	Lala Alakh Sarup ..	12	General demonstration.
Etawah ..	Jak Sira	Babu Ram Sarup ..	50	Zamindar's *sir*, 20 acres Pusa 12 wheat, 10 of American cotton and demonstrations of other crops and of ploughs.
	Partabner	Raja of Partabner ..	50	Farm being laid out, 25 acres Pusa 12 wheat, 10 of American cotton and demonstrations as above.
	Heonra	Tewari Kalka Prasad ..	80	Zamindar's *sir*, Pusa 12 wheat, American cotton and iron ploughs.
	Kuian	Ch. Angnu Singh ..	50	Zamindar's *sir*, Pusa 12 wheat 20, American cotton 10, demonstrations and iron ploughs.
	Etawah	Mr. Alone	20	Pusa 12 wheat and American cotton.
	Sundarpur	Ch. Gayan Singh ..	30	Zamindar's *sir*, Pusa wheat and American cotton throughout the village, implement demonstrations.

Farms and Demonstration Areas on sir Land—(concluded.)

District.	Situation.	Owner.	Area acres.	Remarks.
Etawah ..	Nagarya Lalpur ..	Ch. Beni Madho Rao	30	Pusa wheat 20 acres. Zamindar's *sir*. Plough demonstrations.
	Aurang	Rao Narsingh Rao ..	50	Compact farm, well equipped with implements. All crops recommended by us for the district.
	Baghaipur	Ditto ..	48	Ditto.
	Mahdipur	Ch. Hanwant Singh ..	40	Zamindar's *sir*. Pusa 12 wheat and American cotton and other crops and plough demonstrations.
	Kara	Ch. Lachhman Singh ..	40	Ditto.
	Dalipnagar	Pandit Anand Madho ..	50	Improved wheat, cotton and sugarcane and plough demonstrations.
	Purwa Khuman ..	Ch. Hanu Prasad ..	15	Zamindar's *sir*. All crops recommended for the district and plough demonstrations.
	Bailipur	Pandit Brahma Din ..	30	Specializes on Pusa wheat and imported potatoes.
	Asa	Thakur Jitwar Singh ..	50	Pusa wheat and American cotton and ploughs. Zamindar's *sir*.
	Banthra	ThakurBalwant Singh ..	50	Cotton, sugarcane, maize and ploughs. Zamindar's *sir*.
	Kuderkot	Tewari Sheo Charan Lal	25	All crops and plough demonstrations. Part of *sir*, the village grows about 400 acres of Pusa 12 wheat. Also fodder crop experiment.
	Shahpur	Ch. Beni Madho ..	15	Zamindar's *sir*, wheat, cotton, ploughs.
	Faridpur	Thakur Ram Partab Singh.	18	Ditto.
	Niamatpur Behari ..	Lala Mangi Lal ..	20	Zamindar's *sir*. Pusa 12 wheat.
	Atsui	Thakur Trijugi Narain	30	Do. Pusa 12 wheat and ploughs.
Mainpuri ..	Sikandarpur ..	M Hakim-ud-din ..	20	Do All crops recommended.
	Kosma	M. Hadiyar Khan ..	35	Do. Ditto.
	Fazilpur	Thakur Lochan Singh ..	15	Do. Ditto.
	Kalhore	Thakur Gulab Singh ..	20	Compact block now being cultivated on improved lines. All crops recommended.
	Sagauni	Thakur Dwarka Singh	40	Ditto.
	Lakhaur	Ch. Durga Prasad ..	25	Occupancy land. All crops recommended.
	Jeonti	Pandit Sita Ram ..	15	*Sir* land. All crops recommended.
	Alipur patti ..	„ Chironji Lal ..	15	Ditto.
	Parhena Salempur ..	Thakur Digbijai Singh	50	Being laid out as a farm. All crops.
	Shikohabad ..	Lala Bhola Nath ..	25	Compact *sir*. All crops recommended.
	Nain	Babu Ishar Das ..	10	*Sir* land. All crops recommended.
	Do.	Thakur Manohar Singh	20	Ditto.
	Do.	Babu Moti Lal ..	20	Ditto.
	Ukhrend	Thakur Bishun Singh ..	20	Ditto.
	Havelia	Pandit Sughar Singh ..	25	
	Jasrana	Thakur Hukm Singh ..	10	Mostly reclaimed *usar*.
	Bahtigarh	Thakur Karan Singh ..	20	*Sir* land, practically compact, Pusa wheat principally.
	Garhia Chinkaura ..	Ch. Jang Singh ..	25	*Sir* land. All crops recommended.
	Bintapur	Pandit Bisheshar Dayal	20	Pusa 12 wheat and other crops, compact block of *sir*.
	Lakrai	Thakur Gulab Singh ..	25	Zamindar's *sir*. All crops recommended.
Allahabad ..	Baraon	Raja of Baraon ..	35	Compact farm, Much general demonstration work.
Banda ..	Naraini	Pathak Harbans Prasad	35	Compact farm. Owner ex-student of Agricultural College.
Do. ..	Khurhand	Thakur Har Prasad Singh.	250	Compact farm Specialises on seed production, particularly Pusa wheat.
Farrukhabad ..	Tirwa	Raja of Tirwa ..	Not settled.	Now being laid out, fieldman under training at Cawnpore.
	Kanauj	High School ..	About 40	School demonstration farm. Most crops and implements.
	Shamsabad ..	M. Muhammad Mohsin	28	Owner ex-student of Agricultural College. *Sir* land, not compact at present.

GENERAL DEMONSTRATION WORK.

An attempt has been made, with some success, to maintain a record of village demonstration work during the year. The following table though not complete or exhaustive gives a rough idea of the progress made in this direction :—

District.	Staff.	Villages visited for demonstration work.	* Growing improved crops.					General demonstrations.			Remarks. (Principal demonstrations.)
			Wheat.		Cotton.		Others.	Villages.	No.	Area.	
			No.	Area acres.	No.	Area.					
Cawnpore ‡ ..	5† ..	596	210	2,601 (1)	581	5,633	12 (a)	71	264 (b)	641 (c)	Green-manuring, cotton cultivation, implements.
Etawah ‡ ..	2 ..	111	108	3,186	57	279	53 (1,208 acres).	42	263	185	(a) Cane, Arhar, Maize, Juar, Bajra. (b) Harrows, green-manuring line sowing, ploughing. (c) Excludes ploughing.
Fatehpur ..	1† ..	163	118	1,018 (2)	153	1,009	29	54	238	149	Green-manuring, castor cake, harrowing wheat 85 ploughs.
Mainpuri ‡ ..	1 ..	103	104	1,521	16	69	15	55	70	113	Ploughs, cultivators, line sowing, lever harrowing.
Farrukhabad ..	1 ..	11	..	116 (3)	..	506	20	17	..	85	Ploughs, cultivators and lever harrow.
Unao ..	2 ..	65	42	685	51	255	12	19	40	110	Two hundred and fifty ploughs purchased for current season, lever harrow, green manure.
Hardoi ‡ ..	2 ..	80	68	755	24	93	16	24	47	34	Also 3 tube wells supervised.
Sitapur † ..	.. ..	..	Work recently started, record incomplete.								Do. 2 ditto.
Jalaun (Tahsil Jalaun) ‡.	1 part time	78	64	2,370 (4)	27	230	..	8	28	..	Principally seed-distribution at present.
Banda ‡ ..	3† ..	110	102	2,440 (5)	20 Rice	231 Rice	27	37	54	620	One hundred sugarcane for irrigation *kiaris*, 193 acres lever harrowed for wheat, green manured 60, iron ploughs, cane mills, *gur* pans castor cake
Hamirpur † ..	2† ..	109	99	3,370 (6)	7 Rice	73 Rice	50	101	157	918	Three hundred and seventy acres ridge-makers, As Banda.
Jhansi ..	No permanent staff.	..	Seed issued but no touring assistant.								Two hundred and fifty acres demonstrations of ridge-maker for irrigation kiaris.
Kheri ..	No staff ..	..	..	..	..	..	..	..	..	..	Seed and implements issued and enquiries answered but no staff in the district.
Allanabad ..	Do, ..	..	..	..	..	..	..	..	..	..	

* These figures do not by any means represent the total area under these crops but the areas, so far as ascertainable, in the villages visited for demonstration work.

† Trained labourers in addition.

‡ Experimental or district farms.

(1) 26 villages over 50 acres.
(2) 6 ditto
(3) 4 ditto
(4) 15 ditto and 7 over 100.
(5) 16 ditto
(6) 6 ditto 100 acres.

Cawnpore.

Name of agricultural assistant.	Villages visited for demonstration work.	Growing improved crops.					General demonstration.			Remarks.
		Wheat.		Cotton.		Others	Village.	No.	Area.	
		No.	Area acres.	No.	Area					
1. M. Badrul Hasan ..	141	61	696	140	1,064	6	27	89	244	Areas uncertain owing indirect supplies.
2. Babu Banarsi Das ..	110	56	963	105	1,160	..	18	108	261	
3. Babu Harbhajan Lal	174	47	313	163	1,570	4	11	43	136	
4. Pandit Ganga Prasad Pande.	67	46	629	66	1,050	..	15	15	..	
5. T. Kirti Singh ..	104	..	..	104	789	2	..	..	..	
Total ..	596	210	2,601	581	5,633	12	71	264	641	

Co-operative societies.—With the assistance of the Registrar an effort has been made during the year to utilise the co-operative organisation to a larger extent in connection with the spread of agricultural information, distribution of vernacular agricultural literature and the supply of seeds and implements. The Sandila, Jasrana, Central Banks and the Mainpuri Agricultural Supply Society have continued to run seed stores successfully, but in no case on the scale originally contemplated or at all commensurate with their opportunities and membership. The Hardoi, Bilgram, Fatehpur and Unao Town and Jalaun district banks have assisted in the distribution of seed supplied by the department.

Various schemes have been suggested in the past for the stocking of improved agricultural implements by co-operative banks, but none of these have led to any marked development. During the war the scarcity and uncertainty of supplies and uncertain prices made further progress impossible, but now that conditions are returning to normal the question has been re-examined. Previous schemes have been based on the supply of stocks of implements to central banks on credit, and did not work satisfactorily, nor were the terms obtainable really attractive. A scheme has now been worked out with Messrs. Octavius Steel and Company (Agents for Ransomes, Sims and Jefferies) by which central banks will be given a trade discount of 10 per cent. for cash purchases of a certain minimum size *plus* free freight to the nearest station and permission to add a further 10 per cent. for local retail sales. This enables co-operative banks adopting the scheme to make a gross profit of 20 per cent. and leaves a fair margin of profit after paying interest and working expenses. The stock being the property of the bank, they are free to make such terms as they think fit for supply on credit to members.

The Unao Town Bank have adopted this scheme and started with a stock of 250 ploughs for sale to members and also to zamindars of the districts. Most of these ploughs have already been sold or booked.

Manure dépôts for castor cake and similar concentrated fertilisers for such crops as sugarcane, tobacco and maize also form a suitable opening for co-operative sale and negotiations are in progress with several central banks, with a view to opening such dépôts. But the whole question of the best means of utilising the co-operative organisation for agricultural supplies requires reexamination. It is by no means certain that central banks are the best units for this work, and this matter will be taken up at a joint conference with the Co-operative department shortly.

The Mainpuri Agricultural Supply Society stored and distributed during the year under report 627 maunds of wheat seed on which they made a handsome profit. But this society depends too much for success on the individual efforts of the honorary manager, Pathak Debi Dayal. This society has a zamindari membership and has ample share capital. The essence of the scheme is the growing of pure seed, particularly Pusa 12 wheat, by members for the society's store, but the majority of members do not give the society the backing it requires in this respect.

Strainer tube wells.—Two demonstration tube wells were worked departmentally in the Hardoi district, one in village Tateora and one on the Hardoi farm which also sells water to neighbouring cultivators.

The Tateora tube well had a normal season and irrigated 141 acres of *rabi*, of which 30 acres were irrigated twice, the remainder once. The irrigation charge of Rs. 3-2 per watering per acre covered all running expenses and left a small profit. Interest and amortisation of capital is provided for by an owners' rate on the whole commanded area. As the result of further experiment a suitable form of concrete channel was evolved which costs approximately Rs. 30 per 100 running feet to construct, or from one-third to one-half the cost of previous forms of lined channels tested. Working on this class of channel the duty of the well was brought to over 4 acres per day of 10 working hours, which for light sandy land is a very fair figure. The loss in unlined channels in light soil is very high and the addition of Rs. 2,000 to Rs. 3,000 to the capital cost of the well which the installation of this type of channel involves (for a commanded area of 400 acres) is fully justified.

The Hardoi farm tube well first supplied water to neighbouring cultivators in 1918-19, as their own wells had failed or gave inadequate supplies as a result of the failure of the 1918 monsoon. It is extremely interesting to note that these tenants voluntarily paid the comparatively high rates of Rs. 5 and Rs. 6-4 per acre *per* watering for water from the tube well in *rabi* 1919-20 rather than work their own small wells. Rates were fixed according to the distance of the fields from the well. All channels were temporary and unlined, but the profit on this irrigation was Rs. 261 on a working expenditure of Rs. 235, the area irrigated being 83½ acres. A third well in the district, the property of a small zamindar, has again worked very profitably. There is now a big demand for tube wells by zamindars in this district largely as a result of the Tateora demonstrations. In most cases the installation of these wells will be accompanied by the opening of home farms in the commanded area by the owners. The Katesar tube wells also attracted considerable interest in Sitapur district during the year and there are a number of applications pending with the Agricultural Engineer for wells in that district also. As an example of what can be done in the way of cane growing on tube well irrigation it may be mentioned that the Hardoi farm crops of the new Shahjahanpur farm canes realised as much as Rs. 1,200 per acre, the yield of *gur* being 130 maunds per acre and of cane 1,050 maunds per acre.

Manures.—Dépôts for oil cakes are maintained at the various district farms and at the Nabinagar Seed Store in the Katesar estate. Prices during the year for both castor and *mahwa* cake were high and this practically restricted their use to such crops as sugarcane,

tobacco and potatoes. Demonstrations have been continued so far as circumstances permitted, but many applications amounting to several thousand maunds of castor cake were cancelled on account of the rise in price.

Green-manuring for wheat with san hemp (*Sanai—Crotolaria juncea*) is steadily growing in popularity in certain districts. This method gives regular and certain results on all light soils and combined with the correct use of small iron ploughs is one of the most profitable of the simpler agricultural improvements.

Experimental Work.

Cotton.—Of the pure races isolated from Cawnpore-American C. A. 9 has continued to yield well and work on this cotton is now largely a matter of multiplication of seed and of distribution. As mentioned in last year's report, this cotton was experimentally spun at the Imperial Mills, Blackburn, last year and spun satisfactorily 28s. and 30s. ring twist. The report subsequently received stated that " the cotton was found to spin fairly well and the strength was not much different from that of good 1⅛" Taxas. The yarn was net quite so clean as that spun from the usual quality of Taxas, good middling cotton but altogether we should consider that there should be a fair demand for this style of cotton."

Spinning trials from the 1919 crop have been arranged with two Cawnpore Mills and also with the British Cotton Growing Association. Full results are not yet to hand but the result of one Cawpore spinning showed that this selection is a very marked advance on the original Cawnpore American. The actual count which can be spun from this cotton in India will depend on the time of year when used and on locality. (Bombay has always reported this cotton as suitable for 40s. twist). It has been evident during the past season that there will be a demand in India, if not in Cawnpore, for all the cotton of this class that can be produced for many years to come

Desi Cotton.—The J. N. 1 pure line selection from Bundelkhand cottons has again been grown at the central seed farm for seed supply and large scale testing. As pointed out in last year's experimental farm report this cotton yields well in wet years. The yields at the Kalianpur farm this year (with a monsoon of 28" mostly concentrated between July 15 and September 15) fully bears this out as the total area of 23 acres yielded an average of 960 lbs. *kapas* (several fields yielding over 1,200 lbs. per acre) and 345 of cleaned cotton per acre, as compared with the average for the locality for the year with ordinary *desi* cotton of about 600 of *kapas* and 200 of clean cotton. Trials on other farms gave satisfactory results also. The quality of the lint was well maintained. Spinning trials have been arranged with two Cawnpore mills and the result of one test which is available showed that this cotton is a good cotton for 16s. twist as compared to 10s. for ordinary fine *desi*. Last year's reports showed that J. N. 1 could be used up to 20s.

The position which a cotton of this class will occupy in the near future is a matter of some interest.

It is obvious that there is an almost unlimited demand for it from local and other Indian mills if it can be maintained pure. The recent very marked fall in the price of *desi* cotton and the unusually large margin between " Bengals " and staple cottons in all markets point to a marked demand for a better cotton than Bengals. It was the opinion of more than one spinner who saw and handled this cotton that, if available in commercial quantities, it would fetch prices comparable with many cottons now classed as Oomras. Should the present high premium for cottons of medium staple be maintained it is obvious that considerable care will be necessary to get J. N. 1 cotton into its proper class in the market if the cultivator is to realize the full value for his crop.

Sugarcane.—Three new varieties of sugarcane from the Shahjahanpur Research Farm have given extremely promising results at Hardoi and Etawah, particularly when sown after a rains fallow. The question as to whether high cultivation with medium canes will pay in the *doab* portion of the circle is still under experiment. There seems no doubt that given an assured irrigation supply it is very profitable in such districts as Hardoi and Sitapur. Excellent yields both of cane and *gur* have again been obtained at the Atarra Farm, but it is necessary there to supplement canal by well irrigation and, except on some of the areas commanded by tanks and wells, it is doubtful if any general progress can be made with sugarcane in the Dhasan and Ken Canal divisions unless, and until, a more certain water supply in early *kharif* can be assured.

Wheat.—A series of new hybrid wheats from the Imperial Economic Botanist have been under trial at the Kalianpur farm during the year, and some of them are of great promise. The series of irrigation and cultivation experiments to determine the effect of varying cultivation and irrigation on the yield and quality of wheat was continued and extended. Unfortunately both the variety trials and the irrigation experiments, though yielding interesting results, were seriously interfered with by a most irregular canal supply as long canal closures occurred at critical periods. The matter has been taken up with the Irrigation department with a view to assuring regular supplies without which experimental work is impossible. But it has also to be recognised that the greater the degree of economy attempted in irrigation water the more perfect must be the timing of the irrigation if large crops are to be produced. Irrigation water can only be used to the best effect if the supply is certain.

Experiments with various Pusa grams have been continued and several years' results have shown that Pusa 18 can now be recommended with confidence for most conditions as a

hardy and high yielding variety. Pusa 17 has also done well at many farms and for some districts is better. Pusa 6 is a gram of exceptional quality but requires further testing for yield.

Fibres.—As a result of the world's shortage of flax the question of growing this crop in the province has again been taken up. Previous results obtained at Cawnpore, and confirmed in other parts of the circle, show that in the canal irrigated area flax can be very profitably grown, provided that capital will come forward to undertake the retting, scutching and marketing of the fibre and the supply of suitable seed. These are matters which cannot be left to individual cultivators. During my leave in England the position was explained to the Empire Flax Committee.

Through the kindness of the English Board (now Ministry) of Agriculture, Flax Production department, a supply of English flax seed (Dutch child) was obtained and also a supply of Japanese seed from the Flax Control Board. Both of these varieties yielded well at Kalianpur farm this year, though the straw yields would have been higher had canal water been obtainable at the right time. Previous practice in India has been to store the rippled straw until October before retting and scutching. This involves the locking up of capital for six months and with a very fluctuating market adds to the speculative nature of the crop. Retting and scutching were therefore carried out in April and samples of fibre have been sent to England for valuation. Less difficulty in retting was encountered than was anticipated, though the effect of the high temperatures on the value of the fibre remains to be ascertained. Scutching was difficult until artificial damping was resorted to in the scutching room, but this difficulty would not be insuperable on a commercial scale.

There seems some reason to believe that jute may prove a profitable crop in the Sitapur *Ganjar* tract (the low land between and adjoining the Gogra and Chauka rivers). A series of experimental plots have been arranged in different parts of this tract to test the possibilities. Most of these plots are in Court of Wards' villages, and we are indebted to the Special Manager (Mr. Dunne), whose co-operation has made these experiments possible. A practical jute cultivator to supervise the growing of the crop has kindly been lent by the Director of Agriculture, Bengal.

Motor Tractors.—The very rapid development of the light motor tractor has brought power ploughing within the range of practical politics. Whilst tractors obviously will never come into use on the average small holdings, there are many directions in which they could be profitably employed. The Lincoln trials held in England last year showed that some of the best English makes, and at least one continental make, had reached a high stage of efficiency from an engineering point of view. Less progress had been made with the design of special implements. There are already a number of agents in India selling tractors and, as some landholders are already purchasing tractors, it was imperative that the Agricultural department should be able to advise on and demonstrate the best types for given conditions and also be able to recommend suitable implements without which the best power unit would be useless. Experiments with one make have been in progress since April and tractors by two other makers are expected shortly. The Kalianpur farm is now large enough to enable the question of general tractor cultivation, a problem in which several landholders are interested, to be taken up. The use of tractors for reclamation work and the eradication of deep-rooted weeds in Bundelkhand will be taken in hand during the coming cold weather and their use for dealing with some of the large grass areas in North Oudh is also receiving attention. As the provision of trained drivers and facilities for repair are of great importance, it is satisfactory to note that one firm of English makers have already arranged for a school for tractor drivers and for a good repair shop in Allahabad.

Rice.—At the Atarra farm the testing of varieties is being continued and the most suitable are being distributed in the adjoining rice-growing tract on the Ken canal. The use of Ammonium sulphate as a top-dressing for rice in August-September has given good results at the Atarra farm for some years, and this practice will now be demonstrated in suitable villages.

Reclamation of ravine land.—During the year two large areas of ravine land acquired by Government for improvement in the Jalaun district, viz., the Bohadpura block 822 acres and the Bandha Chamari block 1,331 acres, were handed over to the department. On the Bohadpura block one *bundh* constructed as a famine work is in existence, though it requires strengthening and repair. A second larger *bundh* is in progress of construction. On the Bandha-Chamari block no large *bundhs* have as yet been constructed, and projects for these are at present under consideration by the Irrigation department.

It should perhaps be explained that these schemes are in a purely experimental stage. The deterioration by continual ravining in many parts of Bundelkhand is progressive, and the object of these experiments is not to deal with the main ravines but to ascertain how the higher ravines can be profitably dealt with and existing cultivated land protected from further encroachment. It is hoped that the construction and maintenance of suitable *bundhs* combined with the training of minor ravines may result in the reclamation of a considerable area of land for stable cultivation and that other parts of the area may be profitably brought under *babul* and grass. In certain cases the main *bundhs* will hold up enough water to give a certain amount of *rabi* irrigation. It seems possible that a reclamation scheme, which as an irrigation or cultivation project alone, might prove unprofitable may (by a combination of these methods of treatment) yield profitable results.

The blocks under treatment should eventually afford valuable data for further work. Work during the year has necessarily been largely restricted to surveying, fencing and a limited amount of planting together with the construction of minor *bundhs* to regulate the run-off.

Receipts. - The circle receipts aggregated Rs. 44,408 as compared to Rs. 30,500 budgetted and Rs. 28,167 in the previous year.

Correspondence.—The number of letters received was 5 911 letters : issued 6,344.

General.—Agricultural enquiries (apart from applications for seed, etc) dealt with by post aggregated 1,295 apart from those dealt with direct by touring assistants.

APPENDIX III.

Report on the administration of the Eastern circle of the Agricultural department, United Provinces, for 1919-20, *by Rai Bahadur L. C. Sharma, M.R.A.C., P.A.S.I., Bar.-at-Law, Deputy Director of Agriculture.*

1. Eastern circle consists of 12 districts, viz., Fyzabad, Bara Banki, Lucknow, Rae Bareli, Sultanpur, Partabgarh, Mirzapur, Benares, Ghazipur, Ballia, Azamgarh and Jaunpore. The headquarter is at Partabgarh.

2. *Staff.*—I remained in charge of the Eastern circle throughout the year. On reversion of Babu Brij Lal to his substantive appointment, Mr. Deoki Nandan was appointed as Divisional Superintendent for this circle on 9th June 1919, who worked up to the end of the year. The strength of the staff was affected by the transfer of Babu Jyoti Prasada to the Raya Cotton-farm, district Muttra, and the deputation of Chaudhri Hari Ram Singh to the Hindu University Benares. Babu Parshotam Dass reverted to his substantive appointment from the Colvin Taluqdar School on the 6th May 1920. The number of members of Sub-Agricultural service who worked in this circle during the year under report was 24 as compared with 25 in the previous years. A great want of fieldmen was keenly felt, 5 fieldmen have recently been added to this circle, and it is expected that several more will be added as soon as available.

3. The work of the circle, done during the year under report, may be classified as below :—

I. Experimental Investigations.
II. District Demonstration farms and field demonstrations.
III. General supervision of most of the private farms.
IV. Seed dépôts and seed farms.
V. Miscellaneous work.

1. *Experimental investigations.*—These were chiefly conducted at the Partabgarh and Benares Agricultural stations, and the details of this work together with the results obtained are given in the combined reports of the said stations for the year 1919-20. It will not, however, be out of place to mention here in brief some of the more useful results so far achieved.

(*a*) *Varietal experiments.*—The results of the varietal experiments conducted during the past few years have clearly proved that *pusa* 12 wheat, Ballia and Rewari varieties of barley, Jaunpore maize, Japanese ground-nuts, Sultanpur and Long-marrow fat varieties of *peas* are best suited for this circle. C. 13 wheat was tried at the Partabgarh farm on a large scale. It gave an average outturn of 2,798 lbs. of superior wheat and 5,993 lbs. *bhusa* per acre. The average height of the crop was 5 feet and it stood the winds remarkably well, and this point was appreciated by those who visited this crop just before the harvest. The Economic Botanist has very kindly supplied me 150 maunds fresh stock of C. 13, which will be sown on the selected private farms next year.

(2) Among the thick sugarcane varieties tried at the Partabgarh farm, Ashy Mauritius, Mauritius no. 16 and Lalgainda of Gorakhpore have again done best, giving yields of 9,240 lbs., 5,640 lbs. and 4,000 lbs. of *gur* per acre respectively. Among the medium varieties of cane, S-39 occupied the first position and so did Reora of Benares among the thin varieties of canes.

(3) *Paddy-varietal.*—Among the early varieties Anjana stood first yielding 1,000 lbs seed per acre, while among the late varieties Hiranj, Bansmati of Tapoban and Bansmati of Pilibhit did best, giving a net profit of Rs. 114-13, Rs. 99-3 and Rs. 87-5 per acre, respectively, from this crop alone.

(4) *Cotton.*—As reported in the previous year, very little of cotton is grown in this circle. With a view of introducing one or two best varieties of cotton in this circle, Canwpore-American and J. no. I were tried in Mirzapur and Partabgarh districts. Tney yielded 830 and 770 lbs. of *kapas* per acre, respectively. K 22 variety has been added for trial on various farms (Government and private) this season. It is hoped that it will be possible to put larger areas under cotton next year.

(5) *Poppy.*—An area of 7 biswas was put under a selected variety of poppy (the seed of which was received from the Economic Botanist, Cawnpore) on the Partabgarh farm. The crop yielded 10 seers of opium and 4 maunds of grain per acre. This variety is very rich in morphine contents and secures higher profits if grown even after the ordinary methods of local poppy cultivation.

(*b*) *Dofasli rotation*—Two crops in rotation in the same year ;—Potatoes after Jaunpore maize gave a net profit of Rs. 252-6-8 per acre. This rotation is highly recommended as it pays so handsomely.

(*c*) *Seh-fasli rotation*—i.e., three crops in rotation in the same year. This rotation with Jaunpore maize, potatoes, and tobacco in succession was tried at the Partabgarh farm and gave splendid results, yielding a net profit of Rs. 301-7-10 per acre.

(*d*) *Reclamation of ravine land.*—With a view of reclaiming ravine land and making it into suitable fields for plantations or growing crops, about 10 acres of typical ravine land was taken from the Raja Sahib of Fort Partabgarh on 12 years' lease free of rent at Chilbilla, district Partabgarh. I am glad to add that by the application of the methods detailed in the last year's report, the said piece of ravine land has almost been reclaimed and is quite capable of growing crops of gram, barley, early *arhar* and ground-nuts. The cultivators of the neighbourhood are so well impressed with our methods that they are now adopting them.

(e) *Reclamation of Usar land.*—An account is here given showing the various methods under trial for reclamation of reh or usar land on the Partabgarh, Muswapur and the Sarwanpur farms in Eastern circle :—

(1) By washing off the injurious salts from the Usar land, during the rainy season by deep-ploughings and giving a gentle slope by means of patela to all the fields, so that the rain water falling on these fields may wash out the injurious salts (which become readily soluble in it) into a *nala* or *lake* through a proper drainage system laid out for the purpose. It is essential that mends (or bands) 3" high and 24" broad are made at the lower ends of the fields on which grass is allowed to grow for preventing the rainy water passing over it carrying any soil of the fields with it. Some of the fields so prepared were sown with deep-rooted crops such as *arhar*, Java indigo, dhaincha after green manuring and thorough cultivation, while a few were put under Rabi crops after green manuring and an application of castor cake. In the former case we obtained from $\frac{1}{01}$th acre plot 104 lbs. of *arhar* and from another $\frac{1}{2}$ acre plot 138·15 lbs. of Java Indigo seed, while in the latter 1,400 lbs. of wheat and 1,999 lbs. of *bhusa* per acre was obtained in 1918-19 and from the same plot 1,500 lbs. wheat and 3 610 lbs. *bhusa* during the year under report.

(2) By mixing Thikra in ploughed up and well-drained off usar fields to facilitate airification of the soil and green manuring them with Java indigo. This experiment is conducted under instructions of the Imperial Economic Botanist. Java indigo crop on $\frac{1}{3}$rd. acre gave an outturn of 170 lbs. of seed in the second year.

(3) By holding water in fields by means of bands and growing *dhan* crops in them. This method is quite easy and simple where sufficient water for subsequent irrigation is available from some *nala*, lake or tank. Water from rains alone is found insufficient excepting for the lowest fields of an usar tract. We obtained 12 maunds paddy per acre after this method, but this can be adopted only where ample water supply is available for the subsequent irrigation in case the later rains failed.

(4) By applying gypsum to usar plots so as to neutralise the sodium carbonate present in the soil followed with farmyard-manuring. This method, however, has proved slow and expensive for food crops but does fairly well in the case of plantations. Out of 76 plants planted after this system 67 are doing well.

(f) *Eradication of deep-rooted grasses.*—Thousands of acres in the districts of Ballia, Benares, Partabgarh and Jaunpore have been infested with Roshna weed (Pluchea Lanceolata), which is generally known by the name of Baisurai in the Western districts. This obstinate weed spreads so very rapidly that it soon becomes a danger to the neighbouring cultivators. The Collector of Benares observing the rapid spread of this injurious weed has reported the matter to the Director of Agriculture, requesting the department to take up some effective remedial measures for the eradication of the said weed. The easiest and cheapest way of destroying this weed, so far known to us, is that of "eradication by deep ploughing" as was mentioned in the previous report. The land so reclaimed may be considerably improved by green manuring. Arrangement is being made for securing lands infested with this weed in the Benares and Jaunpore districts and giving demonstrations as to the eradication thereof. Motor plough will be used, if found quite essential.

II.—District demonstration farms and field demonstration.

In this circle there are only two large-sized farms, one in Fyzabad and the other in the Sultanpur district, which can serve the purpose of giving demonstrations on large scales as well as growing improved seeds. The former is a Government Seed Farm, and the latter is taken on lease from Raja of Amethi. There are no Government demonstration farms in other districts of my circle. The work of demonstration is, however, carried out on small scales either by way of field demonstrations or on lands taken on short leases.

Want of a large demonstration farm in every district is very keenly felt and sooner they are started the better. The main object served by these farms is (1) to familiarise the interested zamindars and cultivators of the various districts with the up-to-date practical agriculture, such as better methods of cultivation, cake manures, and the application thereof, the best method of sowing improved seeds and growing crops, the use of improved implements (cultivators' harrows, hand hoes) and the reclamation of usar land, etc. ; (2) to demonstrate on large scales what proved profitable or economical on the Government experimental stations of this circle ; (3) to introduce improved seeds and methods as well as approved implements in the locality.

The following are the small demonstration farms on leased lands on which some selected demonstrations were given during the year under report :—

(1) Sultanpur,
(2) Muswapur.
(3) Rae Bereli.
(4) Charbagh.
(5) Kalli-pachham.
(6) Mirzapur.
(7) Kundi.
(8) Ghazipur.
(9) Ballia.
(10) Ajudhia.
(11) Bikapur.
(12) Marna.

But the stage for which they proved most useful is passed over and large district demonstration farms, well equipped with up-to-date machinery and staff will only meet the demand of the agricultural public in future.

Nine hundred and eleven demonstrations were given in the cultivators' fields during the year under report and the services of fieldmen in this direction are much appreciated by the cultivators. Apart from the demonstrations of improved seeds, ploughing with Meston Plough, harrowing of wheat after the first irrigation, etc, the application of castor, *nim* and *mahua* cakes as manure was also demonstrated with fairly satisfactory results.

III.—General supervision of most of the private farms.

There are now 62 private farms in this circle as compared with 54 in the previous year. Among those started during the year under report, the principal ones are:—

(a) Maholi Farm. | *(c)* Kachonda Farm.
(b) Lalganj Farm. | *(d)* Sarai Shah Alam Farm.
(e) Victory Farm.

Some owners of the private farms have very kindly sent me detailed reports of their respective farms which show the marked success achieved and large profits made on them during this year.

Most of the private farms are being supervised by their respective owners and will pay still more handsomely when properly equipped.

The object of the private farms.

The private farms have created a real co-operation between the Taluqdars and the department and may be looked upon as best agencies for multiplication of superior seeds. They are also serving the object of demonstration farms and spreading improved varieties of seeds in place of the local inferior ones commonly grown by the cultivators. Besides, private farms are the best means of rousing interest for agriculture among the Taluqdars and well-to-do zamindars.

Reports from the other private farms have not yet been received and it is not desirable to delay the submission of this report any longer. A mention in brief here below is made of those farms only that have supplied the necessary information:—

1. *Kurri-Sidhauli farm.*—This farm is owned by the Hon'ble Sir Raja Rampal Singh, K C.I.E., of Kurri Sidhauli, district Rae Bareli. The area of the farm is about 100 acres. The principal crops grown in this during the year under report were Pusa 12 wheat, gram and sugarcane. The pumping plant installed on one of the wells, the water supply of which was increased by means of boring, has considerably improved the irrigation of this farm. A chaudhri well is also being sunk at this farm. This farm supplied 300 maunds seed of Pusa 12 wheat to the Agricultural department, United Provinces, during the year under report, and it is very satisfactory to note that the farm made a net profit of Rs. 1,263-11-0 as will appear from the statement given below:—

Statement showing the financial position of the Kurri Sidhauli Farm during 1919-20.

Name of the farm.	Area of the farm in acres.	Total receipts.	Total expenditure.	Net profit.	Remarks.
		Rs. a. p.	Rs a. p.	Rs. a. p.	
Kurri-Sidhauli ..	100 acres ..	6,777 1 9	5,513 6 9	1,263 11 0	Total expenditure includes the rent of the farm land.

2. *Chandapur*—It belongs to the Hon'ble Raja Chandra Choor Singh of Chandapur, district Rae Bareli, and is managed by a trained manager under the direct supervision of the Raja. The farm grows selected varieties of paddy, sugarcane (thick and thin), Pusa wheat, 12, and a few other crops. The irrigation difficulty has been solved by installation of a pumping plant. A large seed dépôt is attached to this farm by means of which a great effort is being made to replace the inferior stock of the local seeds by the improved varieties.

The following statement shows the financial position of the farm:—

Name of the farm.	Area of the farm in acres.	Total receipts.	Total expenditure.	Net profit.	Remarks.
		Rs. a. p.	Rs. a p.	Rs. a. p.	
Chandapur ..	35·6 acres ..	4268 11 6	1,077 12 3	3,190 15 3	It gives a net profit of Rs. 89-10-1 per acre.

3. *Rahwan farm.*—This farm belongs to Thakur Jagannath Bux Singh, Taluqdar of Rahwan Estate, district Rae Bareli. Its success is due chiefly to the keen interest personally taken by him. The area of the farm is 125 acres. Owing to the installation of a pumping plant on the farm, 63¾ acres Pusa 12 wheat was grown as against 31 acres in the previous year.

The highest produce of this wheat is reported to be 30½ maunds per acre. It made a net profit of Rs. 7,8 3 on the capital investment. This farm supplied 524 maunds, Pusa 12 and Pusa 4 wheat, to the Central Circle, Cawnpore, and 230 maunds to Eastern circle during the year under report.

4. *Rahwan sugarcane farm*:—This farm also belongs to Thakur Jaggan Nath Bux Singh, Taluqdar of Rahwan Estate. Its area is 40 bighas and is chiefly meant for growing best varieties of sugarcanes. The following varieties were tried on 10 acres during the year under report :—

Ashy Mauritius .. .. Saretha
Mauritius No. 16 .. .. Reora
Red Mauritius .. .. J.—33
Stripped Mauritius.
Bombay Paunda.
Lalganda of Gorakhpore.

5. *Undwa farm*.—This farm belongs to Sardar Nihal Singh, Esq., Bar.-at-Law, Taluqdar of Rae Bareli district. It is 61 acres in area and grows selected varieties of wheat, paddy and gram. The following statment shows its financial position for the year under report :—

Name of the farm.	Area of the farm in acres	Total receipts.	Total expenditure.	Net profit	Remarks.
		Rs. a. p.	Rs. a. p.	Rs. a. p.	
Undwa farm ..	61 acres ..	6,904 1 5	3,938 6 0	2,965 11 5	

6. *Parera farm*.—This farm too belongs to Sardar Nihal Singh, Bar.-at-Law, and is 145 acres in area. It is equipped with a pumping plant lent by the department. A very large area was put under Pusa 12 wheat and paddy crops which did satisfactorily well, The farm made a net profit of Rs 1,048-1-8 during the year under report.

7. *Akbarpur*.—It also belongs to Sardar Nihal Singh, Bar.-at-Law. The area of the farm has been extended to 46 acres. The sources of irrigation have been improved to some extent by boring the existing well. This farm, being only about a mile from Rae Bareli, is doing an excellent work by way of demonstrations. It brought in a net profit Rs. 935-15-9. Being encouraged by the results of his farms Sardar Nihal Singh is contemplating of starting a 4th farm at Birah Gobindpur well equipped with the up-to-date machinery. He supplied 220 maunds Pusa 12 wheat to the N. E. circle during the year under report.

8. *Gaura farm*.—This is owned by the Thakurain Sahiba of Gaura and supervised by the Hon'ble Sir Raja Rampal Singh of Kurri-Sidhauli. As a result of careful supervision the farm made a net profit of Rs. 1,244 during this year. The area of the farm has this year been extended to 68 acres.

9. *Kachonda farm*.—This was practically started during the year under report. Some selected varieties of wheat, gram and sugarcane tried on this farm did splendidly well. It is 81·2 acres in area and Sardar Birpal Singh is contemplating of installing a pumping plant on the pucca well which has got ample water supply since boring done to it.

10. *Fort Partabgarh farm*.—This belongs to Raja Bahadur Partab Bahadur Singh, C.I.E., of Fort Partabgarh, and is situated close to his palace on Katra Tank Road. The area of the farm is 50 acres. Pusa 12 wheat and some selected varieties of thick sugarcane were extensively grown. All the members of the Sugar Committee visited the farm and were much pleased to see the splendid crops of sugarcanes. This farm was also visited by his Honour the Lieutenant-Governor of these Provinces, who spent nearly 2 hours in going all over the farm and minutely examining the crops. This farm made a net profit of Rs. 3,314-1-11 during the year under report.

11. *Tala farm*.—This is 60 acres in area and belongs to Rai Bahadur Thakur Raghunath Singh, Taluqdar of Isanpur, district Partabgarh. This is chiefly a sugarcane farm and was visited by the Sugar Committee and also by His Honour the Lieutnant-Governor of these Provinces, who expressed a great pleasure on seeing the peas crop as well as the sugarcane crops (thick varieties) grown from improved seed supplied by the Government farm. This farm was also visited by a number of taluqdars of Partabgarh and other districts who had accompanied His Honour.

12. *Isanpur farm*.—This also belongs to Rai Bahadur Thakur Raghunath Singh, Taluqdar of Isanpur, and is chiefly a wheat and paddy farm. Its area is 70 acres and is doing a useful work in the locality.

13. *Mahuli farm*.—This farm has been opened during the year under report and belongs to Raja Amarpal Singh, M.B.E., Taluqdar of Dalippur, district Partabgarh. The area of the farm is 60 acres, of which a greater portion was put under Pusa 12 wheat. These crops did exceedingly well and the results were very encouraging for the other taluqdars of the neighbourhood. The farm has been equipped with a pumping plant and was visited by Sir S. H. Butler, Lieutenant-Governor of these Provinces during the year under report. His Honour's visits to the Taluqdar Farms during the year under report has roused much interest for agriculture among the taluqdars.

14 and 15. *Bhanwan and Attrora farms.*—These farms are chiefly meant for cotton growing in Mirzapur district and owned by Seth Madusudan Dass, a Rais of Benares. Cawnpore-American and K. 22 cottons are tried on these farms on small scales only for the present.

16. *Victory farm.*—This farm was opened during the year under report by Mahant Pramanandgir and is 300 acres in area. It is best suited for sugarcane and wheat crops. Some best varieties of cotton are also tried on a few bighas.

17 *and* 18. *Kusaha and Dhamrawan farms.*—They are 150 and 80 acres, respectively, and belong to Raja Sahib of Amethi. Selected varieties of sugarcane, paddy and wheat were grown on these farms. The Raja has two pumping plants of his own, for irrigation purposes. Raja Sahib is much interested in farming and very often supervises the operations directly. The crops grown on these farms look more like exhibition crops.

19. *Jang Bahadur farm.*—It is about 50 acres in area and supervised by the Kunwar Sahib of Amethi. It is working with a very satisactory profit.

20. *Diamond farm.*—This belongs to Babu Mata Prasada, Honorary Magistrate and Rais of Benares district. The proprietor of the farm is also a Honorary Visitor of the Government Agricultural Station, Benares. The farm has a seed dépôt attached to it and both are doing a useful work.

Apart from private farms there were 16 District Board School farms in Lucknow district which with the exception of two only, worked with profits. Their main object was to impart instructive lessons on practical agriculture to the students. The seeds were issued to the Secretary of the District Board from the Government seeds dépôts and the profits made indicate not only the higher outturns but also a good supervision and keen interest on the part of the school authorities.

IV. *Seed dépôts and seed farms.*—There are now 23 Government seed dépôts, eight District Board seed dépôts, three Court of Wards seed dépôts and a number of private farms seed dépôts in this circle; with the exception of those mentioned last and one of the Court of Wards, all the others are managed by the Deputy Director of Agriculture. The object of these dépôts is twofold :—

(1) Replacement of the local inferior varieties of grains by those that have proved more profitable.

(2) Multiplication of improved seeds.

The Government seed dépôts of this circle are financed with the permanent and temporary advances made to the Deputy Director. Partabgarh, Rae Bareli, Naugawan (district Sultanpur) and Benares seed dépôts are financed out of the permanent advance of Rs. 15,000 and the others by temporary advances. The financial position of all seed dépôts is highly satisfactory.

It is now a well established fact that seed dépôts, working on organised lines, are a paying concern, but the refund of temporary advances at the expiry of their term is a great hindrance to the desired progress and hence I have proposed that a permanent advance of Rs. 50,000 and a temporary advance of Rs. 1,00,000 for five years may be alloted to this circle for seeds and implements to overcome the existing difficulties.

The total quantity of improved seeds issued from the Government seed dépôts alone during the year under report was 10,061 maunds 7 seers and 8 ch. (viz., 9,342 maunds 17 seers Rabi and 718 maunds 30 seers 8 ch. Kharif) and those sold away on cash to various indentors was 3,982 maunds 36 seers 6 ch. viz., (2,094 maunds 39 seers 15 ch. Rabi and 1,887 maunds 36 seers 7 ch. Kharif) making a total quantity of seeds issued from the Government seed dépôts to 14,044 maunds 3 seers. 14 ch. during the year under report. The quantities issued from the District Board seed dépôts were 4,059 maunds 37 seers. 10 ch. Rabi and 1,306 maunds 21 seers 4 ch. Kharif, making total distribution to 5,366 maunds 18 seers 14 ch.

V.—Miscellaneous work.

(a) Co-operative Societies.—Relations with co-operative societies existing in this circle were maintained more closely during the year chiefly in the matter of seed supply and loan of improved agricultural implements for the benefit of their members.

The following central and district banks had sent in their indents for seeds for distribution amongst members of co-operative societies, which were duly supplied :—

1. Rae Bareli.
2. Sultanpur.
3. Kurwar.
4. Jagdishpur.

With a view to help the members of the district co-operative bank Rae Bareli 60 maunds of selected fresh Pusa 12 wheat was supplied to the Manager of the said Bank at the rate of half a seer cheaper per rupee than that of the market, with the instructions that the fresh seed should be given to such interested members who may be willing to sell the produce thereof to the Bank for redistribution next year.

A list of improved seeds, cake manures and implements that are stocked for sale at various centres of this circle was forwarded to the Registrar, Co-operative Societies, for information, and all the district agricultural superintendents were directed to render every possible help to the co-operative societies of their respective district. Four Meston ploughs and 2 cane-crushing mills were lent to the Manager, Co-operative Society, Badlapur, district Jaunpore, for demonstration purposes, among the members of that society, with the result that the members purchased 4 Meston ploughs and very much regretted the return of crushing mill since their funds were insufficient to purchase them even by instalment system.

(b) Machines and implements.—There was a greater demand for agricultural machines and implements during the year under report than was before. This was due partly to the interest for agriculture that is rising among the taluqdars and other zamindars and partly the scarcity of labour and the high charges demanded by the labourers. The time has now arrived that all kinds of approved machinery should be freely demonstrated on every large Government farm. The stock of machinery on every farm is very much limited at present. We sold away three pumping plants, 128 Meston ploughs, 13 hand cotton gins and a number of hand tools as well as parts of various machinery during this year. The workshop attached to the Partabgarh farm did a very useful work in replacing the worn-out and broken parts of the machinery supplied to the various zamindars in the previous years.

(c) Agricultural exhibitions.—Agricultural shows were held in the districts of Bara Banki, Ballia, Rai Bareli and Mirzapur during the year under report. Dadri Fair (in Ballia) representing purely an agricultural show was the largest and best of all. There was a marked improvement in the quantity of agricultural exhibits, particularly of those grown from seed supplied by the department. As in the previous year, the department exhibited samples of improved seeds and other agricultural products from various farm and seed dépôts. In every show, lectures on agritultural subjects were given and copies of agricultural journals and leaflets freely distributed during the exhibition days. Such of the agricultural machines and implements that could be available from the Government farms were demonstrated to the entire satisfaction of the audience every day. There was a greater demand for the pumping plants and Meston ploughs than for any other machinery.

(d) Cake Manure dépôts.—There are five cake manure dépôts from which caster, nim and mahuwa cakes are issued for manuring purposes.

In all 5,848 maunds of cakes were issued chiefly to the Taluqdar farms during the year under report, and I am glad to note that the application of cake manure to sugarcane, wheat and potatoes resulted in higher outturns and larger net profits in almost every case. The demand for cake manures is rising and would have exceeded the supply by far, were it not checked by the high prices which are practically doubled in some cases.

(e) Monthly Agricultural journals.—Two agricultural journals *Mufid-ul-Mazarin* in Urdu and *Kisanup Kerak* in Nagri were regularly issued every month throughout the year. The total number of articles appeared in them during the year under report was 102. These journals are doing a very useful work in spreading up-to-date agricultural information among the zamindars and others interested in agriculture. I am glad to note that several district agricultural journals have sprung up which very often publish articles from our journals. The editor is doing his best in making the journals more useful in future. The circulation of both the journals has now gone up to 1,150.

(f) Boring work.—There have been four borers under me as shown in the last year's report. The total number of borings done by them during the year under report is 42. Out of these 32 proved successful and ten unsuccessful. In addition to this work some of the Chaudhri wells sunk previousiy were tested which proved successful. Two Chaudhri wells are being bored in village Gajan in the Kalakankar Estate under Court of Wards, Partabgarh. The damand for the boring work in this circle is increasing fast. The work of boring done by the moharrirs is small but sure and certain. The Ajudhia Court of Wards Estate has applied for two sets of boring appratuses which the Agricultural Engineer has promised to supply.

(g) Court of Wards.—Lucknow, Rae Bareli, Partabgarh and Ghazipur court of wards have increased the grain stock of their seed dépôts and rendered considerable assistance to this circle by taking up and giving field demonstrations and starting demonstration farms of their own.

(h) Correspondence.—The total number of letters received and issued during the year under report were 3,042 and 4,407, respectively, against 2,500 and 4,177 in the previous year. These figures do not include the demi-offical correspondence carried on from Camp.

L. C. SHARMA,

Deputy Director of Agriculture, U. P., E. Circle.

APPENDIX IV.

Report on the administration of the North-Eastern circle of the Agricultural Department, United Provinces, for the year 1919-1920, *by* RAI SAHIB BABU GANGA PRASAD, *Officiating Deputy Director of Agriculture.*

Circle and changes.

1. This circle consists of four districts, namely, Gorakhpur, Basti, Gonda and Bahraich.

Mr. W. N. Harvey held charge of the circle from the commencement of the year under report up to 15th March, 1920, when he proceeded on leave for a period of 8 months and 8 days. From that date the circle is in my charge.

2. *Staff.*—The present executive staff includes six junior members of the Subordinate Agricultural service all from the 2 years course of the Cawnpore College, four getting Rs. 60 from 1st April, 1920, and two Rs. 40 each per mensem. Besides these there are four fieldmen, one on Rs. 35 and three on Rs. 30 each, of whom one is a passed man of the two years college course getting Rs. 30 and the rest are unqualified.

The office of the circle consists of one head clerk and six assistant clerks, including a store-keeper, whose post is temporary. The headquarters farm has a farm clerk too on Rs. 25, whose post is temporary.

3. *Farms.*—There are two departmental farms, one at the headquarters at Gorakhpur and the other at Bahraich. The Headquarter farm is about 112 acres in area, all irrigable from an efficient tube well. A large part of it is still under levelling. The portion levelled and laid out was cropped with sugarcane, wheat, gram, ground-nuts and other miscellaneous and fodder crops, the results of which have been interesting.

Among the foreign varieties of cane, Java no. 247, S. 39 and 48 and among the varieties of wheat the Pusa no. 4 gave promising results.

Bahraich farm.—The small demonstration farm of 20 acres at Bahraich started in 1819 was well maintained and improved. Selected varieties of sugarcane and wheat were grown at this farm successfully. Pusa wheat no. 4 did very well.

The projected rice farm at Khalilabad in the Basti district is being opened this year, for which funds have been budgetted and the land selected and marked out.

The Balrampur Raj demonstration farm handed over to the department on 26th May, 1919, to be put into proper working order was surveyed and planned out. The plotting according to the plan is in progress. Sugarcane, wheat, gram, barley, peas, *arhar* and fodder crops were grown on the land which was fit for cultivation and an area of 10 acres is under different varieties of sugarcane planted under trench system. A seed godown and a barrack for coolies were erected at the farm during the year under report. A cattle-shed, quarters for the staff and a house on the tube well pumping installation are further needs of the farm, and it is hoped that the Raj will put up these buildings during this year. Foundation for the staff quarters and the engine house have already been laid. The cattle are at present housed in grass huts. The receipts of the farm are fairly recouping the advance received from the Raj for the working charges of the farm. One supervisor getting Rs. 60 and one fieldman getting Rs. 30 from the circle staff are managing the farm under my direct supervision.

District work.

Wheat.—1,017 maunds Pusa 12 wheat, 57½ maunds of Pusa 4 and 20 maunds of Cawnpore 13 were distributed for seed. The results of all the three wheats have been satisfactory. But Pusa no. 4 has done the best throughout the circle. The reason seems to be that it ripens little earlier and the time of growth for wheats in this part of the country is short. On account of the short period of growth the varieties which require a certain period for the full development of their grain show a tendency to shrink in the size of their grain and give less outturn.

The demand for our seed is daily increasing.

Sugarcane.—Of the several varieties tested at the Gorakhpur and Bahraich farms the Java no. 247 has been found better and 1,023 maunds of its canes were distributed during the year for seed and a fairly large quantity of S. 48 and 50 were also distributed.

Further investigations of other varieties of cane are necessary before they can be recommended for extension by the public.

Miscellaneous.

1. Moderate quantities of maize, gram, barley, early *arhar*, *juar*, ground-nuts and castor were distributed for seed.

2. Owing to the high prices of the materials the demands for implements did not increase. Only 31 Meston, Watt's and A. T. ploughs and a few chainpumps and chaffcutter were sold.

3. *Correspondence.*—The total number of letters received and issued during the year was 955 and 920, respectively.

GANGA PRASAD,
Deputy Director of Agriculture,
North-Eastern Circle, Gorakhpur.

APPENDIX V.

Report on the administration of the Agricultural College, Cawnpore, for the year 1919-20.

The report is drawn up by the Warden M. Abdul Qayum, Mr. Clarke, who held the office of Principal, being absent.

The post of Principal was held by Mr. Clarke in addition to his own duties as Agricultural Chemist to Government, United Provinces, throughout the year except for the last two months, when he went on deputation to Java with the Indian Sugar Committee and Mr. Youngman, Economic Botanist to Government, United Provinces, officiated. Mr. Clarke continued also to be Professor of Agriculture and in charge of the Agricultural library.. No Professor of Agriculture is yet appointed.

M. Abdul Qayum held the charge of the Warden's post all the year round, in addition to his being the Assistant to Principal and Superintendent of the College farm.

No more lecturers were appointed during the year under report.

The final and annual examinations could not be held in the month of April owing to an outbreak of plague. They are to be held in July, 1920.

The external examiners appointed by the governing body are as under:—

Agriculture.—W. Roberts, Esq., B.Sc., Principal, Punjab Agricultural College, Lyallpur.

Botany.—The Economic Botanist to Government of the Punjab.

Chemistry.—B. H. Wilsdon, Esq., B.A., Agricultural Chemist to Government of the Punjab.

No results of the examinations enumerated above for the reason stated are available. Several indents for the passed students are pending in the office, and probably there will be no difficulty in getting posts for those who will require service after passing out. It is also probable that more men might be taken by the department which is expanding. No passed diplomates are now available.

Admission for the session 1919-20 were already reported last year. Admission for the year 1920-21 are not yet decided, but it appears that they will be as satisfactory as last year. Out of 26 students admitted in the Vernacular course we have this year eight students from the big landowners who do not want Government service and who joined this class because of the educational qualifications wanting in them to follow the Diploma course in English. The revenue represented by this class is Rs. 22,788.

Diploma course.—This branch of the College course has increased in popularity among the taluqdars and big landlords and several are joining to take up agricutulre as their life profession. Out of 13 selected so far eight do not desire Government service. The revenue represented so far is Rs. 15,049.

During the year a Plant Pathologist was appointed and thus has filled the long-felt vacancy.

The schemes for the extension of the laboratories and equipment of the College are in progress.

Steps are being taken to improve the practical agricultural side of the work. The College farm is being increased and equipped with latest scientific machinery. Projects have been sanctioned for the dairy farm and others are being considered for the following:—

1. Special quarters for students requiring better accommodation.
2. Boarding-houses for ordinary students.
3. Dining halls.

A separate veterinary hospital has already been constructed during the year.

W. YOUNGMAN,

Officiating Principal,
Agricultural College, Cawnpore,
United Provinces.

APPENDIX VI.

Report on the administration of the Botanical section for 1919-20 *by* MR. W. YOUNGMAN, *officiating Economic Botanist to Government, United Provinces.*

I HELD charge of the section as officiating Economic Botanist to Government throughout the year. I also held charge of the Botanical section of the College and was also entrusted to carry out the cotton survey work. Babu Ram Prasad held charge of the current duties of the Assistant Economic Botanist to Government, United Provinces, during the year.

Cotton.

At the commencement of the 1919 season the section was called upon to initiate the cotton survey of the indigenous cottons of the Province, as recommended by the Indian Cotton Committee in their report. Although time for making preparation was short and our staff was inadequate for any large undertaking, yet a fairly detailed survey of the cottons of the Moradabad civil district was made. Several collections of seeds were made and these seeds are being grown on the Cawnpore farm this year where they will be carefully examined to see if they show any sign of promise. In connection with this cotton survey I should like especially to mention the good work done by Babu Hira Singh who, amongst others, was lent us by the Western circle. Some selections of the Perso-American type of cotton grown on the Cawnpore farm are being separated out into pure lines in the case of the more promising forms. Hybridization work of the promising types was also continued during the year.

At the Raya seed farm several cottons were tried on a field scale.

Sesamum.

A fairly representative collection of the "tils" of the Province were grown at Cawnpore and a selection of these will be carried on and purified another season.

The Raya Seed farm.

The laying-out of the farm and the erection of the buildings have been completed. A great deal of work has had to be done in levelling the fields, and this has not yet been altogether completed. Some 50 acres are under crop with cotton for the coming season.

W. YOUNGMAN,
Officiating Economic Botanist to Government
United Provinces.

APPENDIX VII.

Report on the administration of the Chemical section for the year 1919-20 *by* PANDIT TEJ SHANKER KOCHAK, *Officiating Agricultural Chemist to Government, United Provinces.*

DURING the year under report G. Clarke, Esq., F.I.C , F.C.S., was in charge of the office of Agricultural Chemist to Government, United Provinces, up to 12th May, 1920, when the Government of India requisitioned his very valuable services to work as a member of the Indian Sugar Committee, and the undersigned, as once in the past, was placed in charge of the section.

The Director very kindly placed the undersigned in charge of the Agricultural library also.

There has been no change in the professorial staff this year. The College is full, and the theoretical and practical teaching of Chemistry and Physics continues on the lines previously laid down by G. Clarke, Esq., F.I.C. F.C.S. The popularity of the two years' course continues as usual.

The work at Shahjahanpur Sugarcane Research farm continues satisfactorily as usual, The seedlings received from the Sugarcane Expert, Coimbatore, as mentioned in last year's report, have been put in this year on a field scale. The maintenance, improvement and introduction of new varieties of canes, as of other crops of economic value, is not left to chance under a regularly organized and civilized Government; it is for the first time in the Indian history that in these provinces this farm has begun to do the above work in regard to sugarcane so successfully and in such a thorough scientific manner. It is the work the value of which can never be overestimated.

A greater part of the west of these Provinces is infested with the weed *baisurai* (*pluchea lanceolata*). On the initiative of Dr. A. E. Parr, Ph.D., Deputy Director of Agriculture, the study of the weed has been taken up in hand and Mr. S. C. Banerji, F.C.S., Assistant Agricultural Chemist to Government, has been entrusted with it. Its result will be of scientific importance and of great economic value.

T. S. KOCHAK, B.A., S.C ,
Offg. Agricultural Chemist to Government,
United Provinces.

APPENDIX VIII.

Report on the administration of Agricultural Engineering for 1919-20, *by* Mr. F. HOWARD VICK, M.I.M.E, *Agricultural Engineer.*

THE year has been remarkable for the greatly increased demand for Plant of all sorts, engines and pumps, tube wells, sugarcane mills, rice hullers and sugar centrifugals being amongst the items asked for. This demand is widespread as not only does it come from practically every district of this Province, but enquiries are constantly coming from many of the States of Rajputana and Central India and from Bihar and Orissa. I cannot, of course, deal with enquiries outside this Province except to give a little advice, or to put an enquirer in touch with a firm who will supply his wants.

This increased demand year by year for mechanical power points to scarcity of, and higher prices for, labour for farming operations, and this being the case it is certain that there will be a constantly increasing demand by farmers for all sorts of labour-saving machinery from the Agricultural department.

The demand also points to increased prosperity amongst zamindars and farmers ; the high prices for farm produce ruling during the past few years has undoubtedly placed them in a better position to purchase machinery.

Unfortunately I cannot report so favourably on the supply of, as on the demand for, labour-saving contrivances. There is still a huge shortage, amongst firms in India, of all sorts of machinery. The pre-war position as regards stocks has in nowise been regained, as only a comparatively small amount of plant from England is available for the Indian market. Firms in India have long waiting-lists for such ordinary articles as oil engines, and so it is with great difficulty and only at very high prices that we can now obtain machinery. Neither is it possible to get at the present time any quick or extensive delivery of plant through the India Office Stores, English firms being so overloaded with orders that they cannot comply fully with all demands. It now takes somewhat over a year to get goods out through the India Office, whereas before the war it took only three or four months.

Owing to this greatly increased demand in the Provinces for labour-saving plant, I put up to Government, in June, 1919, a scheme for greatly enlarging the scope of my branch of work in the department. Government is favourably considering this matter, and I hope therefore that I shall soon be in a position to deal effectively and expeditiously with all the demands made upon me for plant.

Under this scheme of reorganisation of the engineering branch the Province will be divided into six circles, each in the charge of an Assistant Agricultural Engineer with his own staff of mechanics and boring assistants and with his own plant for carrying out the work within his circle. It is certain that a centralized system of this sort will save much time in carrying through pumping schemes and erection of plant of all sorts.

These six circles of the Province will be under the superintendence of the Agricultural Engineer at headquarters Cawnpore, and all schemes will be worked out, and estimates of cost made, in the headquarters office. It is hoped that by next year the scheme will be in operation.

To go into details of work for the year under the various heads :—

Tube wells and pumping schemes have been carried through to the extent of the available plant. Thus six tube wells with engines and pump have been completed and set to work, whilst eight more are in course of construction.

Sugar Mills are in increarsed demand, and when I can obtain an adequate supply I anticipate a large sale of these. As illustrating the usefulness of these I will mention one particular instance. I erected a crushing mill and oil engine for a small zamindar in Gorakhpore district last season. The mill crushes about 27 maunds per hour. The man after one season's working has now come to me for a mill three times the size for next season's work. He dealt last season with at least one lakh of rupees worth of produce with the plant I erected, and his profits must be in the neighbourhood of Rs. 30,000 for the one season's work. The total cost of the plant, engine and mill, including erecting charges, was only Rs. 5,000. He will be working next season with a much bigger plant and his turnover, and in consequence his profits will be much bigger.

Mechanical Engineering Classes for College students have been carried on as usual throughout the year and keenness is shown by students in the work. I should like to see an annual examination in engineering at the College as in other subjects, so that there could be some gauge as to the proficiency attained.

F. HOWARD VICK, M.I.M.E.,
Agricultural Engineer to Government,
United Provinces.

CAWNPORE:
The 25th July, 1920.

APPENDIX IX.

Note on Arboricultural Operations during 1919-20.

Summary of work done.—New planting was done on 159 miles of local and 34 miles of provincial roads as compared respectively with 177 and 34 miles provided for in the working plans. Out of 159 miles planted on local roads, 5 miles were planted by private persons in Allahabad (1 mile), Benares (1 mile), Jaunpur (2 miles) and Bara Banki (1 mile). The planting of unsuitable trees in the Province had almost ceased, but during the year under report 111 trees of siris, 10 of tun, 3 of kachnar, 11 of nimchameli, 5 of semal and 16 of bakaen were planted on local roads and 25 of siris, 282 of tun, 11 of kachnar, 27 of cork and 83 of bakaen on provincial roads, of certain districts.

Working plans.—The majority of the districts carried out their working plans, but divergences occurred in several districts on local roads. In three districts only gap-filling was done, while lack of funds owing to high rates of wages prevented plantation in two districts. In two districts plantation was postponed for want of seedlings or young plants, while flood in the rivers Ram Ganga and Ganges was the cause of divergence in other two districts. In two districts work was done in excess of that provided for in the working plan, to make up the deficiency of past years.

Extension of avenues.—The reports received during the year show that 15 miles of "paper avenues" have been further removed from the records and 218 miles of recent plantings established.

Training of supervisors.—No training class of supervisors was held during the year, as the number of trained candidates still exceeds the need of the district boards in the Province.

Financial results.—The expenditure on provincial roads was 80,203, while the receipts were Rs. 28,452. The net cost to Government was Rs. 51,751 against Rs. 49,336 in the previous year. The increase in expenditure was apparently due to the enhanced cost of labour. The income too, however, rose from Rs. 24,955 to Rs. 28,452 yielding an increase of Rs. 3,497, probably through high prices. The expenditure on local roads was Rs. 1,48,672 or Rs. 19,172 more than in the preceding year. The receipt fell from Rs. 66,291 to Rs. 64,554.

ORDERS OF GOVERNMENT.

No. 3303/I—175-1920.

RESOLUTION.

REVENUE DEPARTMENT.

Dated Allahabad, the 23rd November, 1920.

READ—

Letter no. 1801/460-B., dated the 4th October, 1920, from the Director of Agriculture, United Provinces, being the report on the administration of the department of Agriculture for the year ending the 30th June, 1920.

OBSERVATIONS.—The history of the department of Agriculture in the year 1919-20 is, as was its predecessor, the history of a period of preparation. There has hitherto been no material improvement in the opportunities for recruitment to the Indian Agricultural Service and the strength of the provincial cadre remains practically the same as before. The necessity for an extension of the activities of the department in all its branches has been rendered more acute by the retardation since 1914 of its normal gradual expansion and by the great quickening of public interest in agricultural matters due to the world-scarcity of food-grains and raw materials. During the year schemes have been prepared and have received the approval of Government for a practically entire reorganization of the department in all its branches, (1) demonstrational and experimental, (2) educational and research, (3) engineering, and (4) cattle-breeding.

2. The first scheme contemplates a division of the province into ten agricultural circles based on territorial and soil peculiarities, each circle constituting as it were an agricultural tract. At present there are only four circles: these are unwieldy and heterogeneous. Under the new scheme at the headquarters of each circle there will be an experimental farm, and each district in the circle will, it is hoped, ultimately have its own district farm which will be used to test on a large scale in the varying conditions of each district the results of the experiments which have been successfully carried out at the central farm. Under this system the peculiarities of each tract will receive special study and experimental results will be further tested for every district. It is possible that ultimately farms may be established departmentally or by private agency in all tahsils. This will involve a very large increase in the Indian Agricultural Service, the Provincial Service and the Subordinate Service.

3. In order to meet the demands from the agricultural community and to provide the necessary education for the vastly increased staff required for the expanded activities described above and also to meet the growing necessity for research work, a large expansion of the Agricultural College at Cawnpore is a matter of urgent necessity. This involves extension of the college buildings, expansion of the farm and expansion of the professorial, tutorial and research staff. The college at present is extremely short-handed, both on the teaching and research side, and with the increased size of the classes the doubling of the staff in certain sections will become inevitable and additional officers for

research will also be required. The ultimate aim of the college will be to attain to the full university standard.

4. The demand for irrigational facilities, particularly tube wells, has now reached a stage where expansion of the staff is vital to progress. Owing to difficulties in the procuring of plant and shortage of staff the applications of the last few years have accumulated to an extent which will necessitate for some time to come the annual construction of about 200 tube wells by the department. It is most unlikely that, when the benefits of these mechanical appliances are better known, the demand for these wells will ever fall below this figure. The scheme now approved by Government provides for the division of the provinces into circles under the charge of two Agricultural Engineers and a staff of six Assistant Engineers. The setting up of a workshop and supply dépôt for machinery and repairs will also be provided for. The question of the use of tractors and similar mechanical appliances is not being neglected; but owing to lack of information in India and owing to the very rapid progress that is being made and the rapid changes that are taking place in the development of this branch of engineering in Europe and America, no definite scheme has yet been decided upon.

5. The administration of the cattle-breeding section has recently been transferred from the charge of the Civil Veterinary department and a Deputy Director of Agriculture has been recruited by the Secretary of State for this special charge. After a preliminary survey of the provinces a scheme has now been approved which will involve the establishment of two large cattle ranches, the first in the western and the second in the central portion of the provinces. A third may possibly be required in future in the eastern tract.

6. Owing to the difficulties of recruitment for the Indian Agricultural Service, the difficulties of obtaining suitable trained staff for the Provincial and Subordinate Services and the difficulties of obtaining plant and also owing to financial considerations, the expansion of the department as described above must necessarily be a matter of a considerable number of years, but it is hoped that financial provision will be made available for a very practical beginning in the ensuing year.

7. No great progress is reported in the research work on cotton and sugarcane. Work has been hampered by the depletion of the staff, and in the circumstances no very substantial progress could well have been expected.

Improvements, however, have been made in the breeds of American cotton and arrangements for a large scale demonstration of the Cawnpore-American cotton no. C.A.9 are being made. Good results from medium staple cotton have also been obtained. The future of this class of cotton, however, is uncertain. The question of improved types of sugarcane is intimately bound up with questions of irrigation and power-crushing. The report of the Indian Sugar Committee which is dealing with these questions is expected shortly and the direction of further research will be considered on receipt of this report.

Experiments for the improvement and extension of fibre crops have also been carried out. The results in the case of flax are so far promising and experiments made with hemp and jute appear to indicate that profitable cultivation may be possible in parts of the provinces where conditions are suitable to their growth and where they will not come into competition with food crops.

8. In spite of the shortage of staff the work of the college has continued to be successful and His Honour is glad to note the increase in its popularity as indicated by the number of applications for admission. Sir Harcourt Butler regards this as an encouraging indication of the growing interest which the younger generation of the landed gentry of this province is taking in scientific agriculture.

The institution of agricultural schools of the middle standard is still under the consideration of Government as, should the recommendations of the Calcutta University Commission materialize, such middle schools would have no definite place and the question of raising their standard to that of intermediate colleges would have to be decided.

9. The basis for the arrangement of the supply of pure seed to cultivators requires broadening as it has now reached a stage with which the department has not the capacity to deal. It is hoped that the assistance of the co-operative banks may now be enlisted.

10. The work of this department reflects credit on those who have borne the strain uncomplainingly. The depletion of the staff has been such that almost every member of the superior staff has been holding charge of two appointments. Sir Harcourt Butler accordingly desires to thank Mr. Leake and through him the staff of the department, Imperial, Provincial and subordinate, for their zealous and unsparing labours. He takes this opportunity also of thanking the Board of Agriculture for the assistance and advice which they have so readily given.

ORDER.—Ordered that a copy of this resolution be forwarded to the Director of Agriculture, United Provinces, for information.

Ordered also that this resolution be published in the *United Provinces Government Gazette.*

By order,

H. S. CROSTHWAITE,

Secy. to Govt., United Provinces.

(Prescribed limit of the report, 20 pages.)

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Glossary.

English or Vernacular.	Botanical names or English equivalent.
Arhar	Cajanus Indicus.
Baisurai	Pluchea Lanceolata.
Bajra	Pennisetun Typhoideum.
Barley	Hordeum Vulgare.
Bel	Pans and furnace used for making rab or massecuite.
Chin	Variety of indigenous sugarcane.
Deshi	Indigenous.
Dhaul	Variety of indigenous sugarcane.
Flax	Linum Usitatissimum.
Gram	Cicer Arietinum.
Groundnut	Arachis hypogaea.
Gur	Raw sugar.
Juar	Sorghum Vulgare.
Kapas	Gossypium Neglectum.
Kharif	Autum harvest.
Khudkasht	Home Farm.
Maize	Zea mays.
Maund	82 $\frac{2}{7}$ lbs.
Rab	Masse cuite.
Rabi	Spring harvest.
Rakra, Reora, Saretha	Varieties of indigenous sugarcane.
Roshna	Pluchea Lanceolata.
Sawai	With 25 per cent. interest in kind.
Seer	2 lbs.
Sir	Home farm.
Sugarcane	Saccharum officinarum.
Til	Sesamum Indicum.
Wheat	Triticum Sativum.

Errata to the Report on the Administration of the Department of Agriculture, United Provinces, for the year ending 30th June, 1921.

Page.	Line.	Para.	*For.*	*Read.*
3	26	11	Jhansi, Bahraich and Allahabad.	Jhansi, Basti, Bahraich and Allahabad.
15	27	40	Are primarily the work of of Agricultural Department.	Is primarily the work of the Agricultural Department.
16	20	41	300 acres	200 acres ... ...

Report on the Administration of the Department of Agriculture, United Provinces, for the year ending 30th June, 1921.

No. $\frac{1597a}{1-179}$ OF 1921.

FROM

G. CLARKE, ESQ., M.L.C.,
OFFICIATING DIRECTOR OF AGRICULTURE,
UNITED PROVINCES,

TO

THE SECRETARY TO GOVERNMENT,
UNITED PROVINCES, INDUSTRIES DEPARTMENT,
ALLAHABAD.

Dated Lucknow, the 29th of September, 1921.

SIR,

I HAVE the honour to submit the report on the administration of the Department of Agriculture, United Provinces, for the year ending 30th June, 1921.

CHAPTER I.

ADMINISTRATION.

Officers of the staff.

2. Dr. H. M. Leake held charge of the department until the 20th February, 1921, when he proceeded on combined leave. I held charge of the department for the remainder of the year under report.

I was nominated a member of the Legislative Council by His Excellency and took my seat on the 20th February, 1921, and have served as a member of the following Boards and Committees :—

(1) Development Board.
(2) Board of Agriculture (Vice-President).
(3) Board of Industries.
(4) Governing Body of the Agricultural College, Cawnpore (President).
(5) Provincial Cotton Committee (President).
(6) Foreign Scholarships Selection Committee.
(7) Senate of Benares Hindu University.
(8) Committee appointed to consider the question of affiliating to the Allahabad University the Thomason Engineering College, Roorkee, and the Agricultural College, Cawnpore.

I retained under my personal charge the Sugarcane Research Station, Shahjahanpur.

3. Dr. A. E. Parr remained in charge of the Western Circle throughout the year and was appointed the representative of the United Provinces on the Indian Central Cotton Committee. He attended the first meeting of the committee in Bombay from the 19th to 22nd July, 1921.

Mr. B. C. Burt held charge of the Central Circle until the 31st March, 1921, when his services were placed at the disposal of the Government of India for appointment as Secretary of Indian Central Cotton Committee, Bombay. He was relieved by Mr. T. R. Low, who was appointed to the Indian Agricultural Service by the Secretary of State and joined the department on the 3rd December, 1920.

Mr. W. N. Harvey took over charge of the North-Eastern Circle, Gorakhpur, from Rai Sahib Ganga Prasada on return from leave on the 26th January, 1921, and remained in charge.

Rai Bahadur L. C. Sharma was in charge of the Eastern Circle throughout the year, except for a short period of privilege leave, when Mr. Deoki Nandan officiated for him. The Secretary of State has sanctioned the appointment of the Rai Bahadur to the Indian Agricultural Service, with effect from the 25th May, 1921.

4. Mr. Youngman, Economic Botanist to Government, officiated as Principal, Agricultural College, in addition to his own duties during July, 1920. I held the post from 18th November, 1920 to 19th February, 1921. Dr. H. E. Annett officiated as Principal for the remainder of the year in addition to his own duties in connection with opium research.

The post of Warden was held throughout the year by Khan Sahib Abdul Qayum, who received the title of Khan Sahib in June, 1921.

Mr. W. Youngman held charge of the post of Economic Botanist to Government throughout the year, and Babu Ram Prasada officiated as Assistant Economic Botanist.

Mr. P. K. Dey, Plant Pathologist to Government, remained in charge of his section, except for a short period of privilege leave.

Mr. P. B. Richards was appointed by the Secretary of State to the Indian Agricultural Service, and joined his appointment as Entomologist to Government on 18th March, 1921.

The post of Expert Agriculturist, Agricultural College, remained vacant.

The post of Agricultural Chemist was held by Pandit Tej Shankar Kochak, Lecturer, Agricultural College, during my absence with the Government of India. Since 19th February, 1920, Dr. T. M. Singh, who was appointed to the Indian Agricultural Service as Assistant Agricultural Chemist, officiated as Agricultural Chemist and Mr. S. C. Banarjee as Assistant Agricultural Chemist. Dr. T. M. Singh proceeded on leave on medical certificate on 16th of July, 1921, being relieved by Lala Har Narain Batham, Senior Lecturer in Chemistry.

5. Mr. F. H. Vick, Agricultural Engineer to Government, was in charge of his section throughout the year.

6. Mr. C. H. Parr, Deputy Director of Agriculture in charge of Cattle Breeding, held charge of his office.

7. Saiyid Ali Sajjad remained in charge of my office in Lucknow and was appointed Secretary of the newly constituted Board of Agriculture. He has recently been promoted to the United Provinces Agricultural Service and appointed Personal Assistant to the Director.

8. Khan Sahib Muhammad Naib Husain, United Provinces Agricultural Service, has acted as my temporary Personal Assistant for sugarcane research from 21st February, 1921.

Development of the department.

9. During the year under review a beginning has been made in the reform and re-organization of the department foreshadowed in previous reports. The line on which development should proceed has been the subject of discussion in the Legislative Council and the Board of Agriculture. The methods of the department have been subjected to searching criticism, and some defects of organization have been disclosed.

As a result of the full and free discussion which has taken place the Agricultural Department is now in closer touch with the needs of the province than at any previous period of its history and is able to proceed with a knowledge of the demands that will be made on it in the future.

The need for expansion is admitted on all sides. There is evidence that we are on the eve of a great awakening of interest in agricultural development in these provinces. Criticism of the department's activities has revealed a vast body of public opinion well informed regarding agricultural problems, anxious for progress, and determined that advance shall be along sound economic lines.

Although the financial situation did not admit of the complete demands being met, sufficient provision was made for considerable expansion.

The United Provinces Agricultural Service, the scale of pay of which is Rs. 250—25—750, has been increased by 12 posts : seven have already been filled, five by promotion of senior members of the Subordinate Agricultural Service.

Recommendations for filling the remaining posts by promotion of the existing staff have been made.

A junior Accounts Officer recommended by the Accountant-General, Allahabad, was appointed to the United Provinces Agricultural Service and posted to the Central Circle.

Recent occurrences have shown that the control of the finances of a large circle requires an expert Accounts Officer. The large financial transactions in which the department is involved in connection with seed and implement advances are quite beyond the capacity of an ordinary office staff. It is also desirable that a simple system of book-keeping, suitable for farm accounts, should be worked out. If the appointment of an Accounts Officer proves satisfactory it may be desirable to make similar appointments to the larger circles.

Twenty posts were sanctioned in the Subordinate Agricultural Service. Twenty appointments have been made from the passed students of the Agricultural College, 9 from the four years' diploma course in the Rs. 110 grade and 11 from the two years' course in the Rs. 65 grade. One member of the Subordinate Agricultural Service has been discharged as unfit for further service in the department and three probationers were not confirmed at the end of their probationary period. The sanctioned strength of the Subordinate Agricultural Service is now 124.

10. The superior staff of the Agricultural Engineering Section of the department has been increased by the appointment of a Second Agricultural Engineer and three Assistant Agricultural Engineers. Mr. W. H. Cossar, Municipal Engineer, Multan, has been selected for the post of Second Agricultural Engineer and will join his appointment on 1st November, 1921.

11. It was decided to open no new farms, unless a strong local demand is expressed, until the work of the existing farms has been examined. The acquisition of land for farms at Jhansi, Bahraich and Allahabad was accordingly stopped.

It was not possible during the year under report to inspect all the farms in the province. Those which were visited, although in some cases susceptible of improvement, are capable of fulfilling a useful purpose. An exception to this is the Orai farm in the Central Circle. The farm was opened in 1902. The total expenditure on running charges and staff, exclusive of initial cost of land, buildings and equipment from 1902 to 1921, has been Rs. 1,11,379-14-10. The receipts for the same period have been Rs. 16,727-7-10. No results commensurate with the expenditure involved have been, or appear likely to be, obtained. The farm has been a considerable annual burden on the resources of the department, and I recommend that it should be closed.

The Agra Zamindars' Association has been asked to give their opinion regarding the continuance of the Muzaffarnagar farm, and if they advise that it be continued, to suggest the lines on which it should be run in order to give the maximum benefit to the zamindars and cultivators of the district. The recommendations made with regard to this farm will depend on their reply.

12. It may not be out of place here to point out the necessity for experimental farms in the development of agriculture. The point has been emphasized in previous reports by my predecessors. It is readily admitted by all that seed stores for the supply of pure seed to cultivators are desirable and a suggestion was made recently that one should be established in every tahsil. The value of demonstration on the cultivators' own fields by the staff of the department is readily acknowledged to be the only method of disseminating knowledge of better methods. It is useless to erect a seed store unless there is seed of improved varieties of crops to put into it. New methods of cultivation cannot be imported wholesale from other countries; these have to be worked out in great detail to meet the special conditions of soil and climate existing in India. The improvement of Indian agriculture to be permanent and effective must be based on sound experiment and research. The interests of the province will, I venture to suggest, be best served by raising the standard of work of experimental and research farms to the highest possible pitch of efficiency and by increasing rather than diminishing their number.

District and demonstration farms are on a different footing. These exist to illustrate the practical value of new methods and new varieties of crops. The

best test that can be applied to them is that they should show a profit. Those that cannot answer this test will be unhesitatingly closed.

13. The Board of Agriculture met four times during the year. The Board was reconstituted by Government resolution no. 193/I—241, dated the 21st January, 1921, with Mr. H. R. C. Hailey, C.I.E., as President and the Director of Agriculture as Vice-President. Important questions of agricultural policy were referred to it by Government and its advice was taken on all matters relating to the re-organization and development of the department.

CHAPTER II.

AGRICULTURAL EDUCATION.

The Agricultural College.

14. The number of applications received for admission to the Agricultural College shows that the demand for agricultural education continues to grow. One hundred and sixty-six applications for admission were considered during the year by the Selection Committee of the Governing Body. One hundred and fourteen for admission to the two years' vernacular course and 52 for admission to the four years' diploma course: of these 33 were admitted to the former and 25 to the latter. The admissions were limited by boarding-house accommodation, and it is regretted that the plans for additional boarding-house, special quarters, and Hindu dining hall which were asked for in August, 1919, and which have been recommended by the Board of Agriculture and the Governing Body of the College, have not received final sanction.

The results of the examination held in April, 1921, show that the students admitted are able to take full advantage of the instruction, and to reach the required standard. In the four year's diploma course 15 students sat for the final examination, and all obtained the diploma. In the two years' vernacular course 17 students sat for the final examination and 15 passed. Twenty students, as mentioned in chapter I, have been appointed to the posts in the department.

Students who have passed the diploma qualifying examination in the third year and who have shown special aptitude for scientific work are allowed to take either botany or chemistry as the special subject for the fourth year. This year one student elected to take chemistry, specialising in the chemistry of sugar technology. He has passed the final examination conducted by Dr. Sen of Pusa, and it is anticipated will obtain employment in a sugar factory as chemist. The department possesses in the laboratories of the chemical section and at the sugarcane research station, Shahjahanpur, special facilities for training sugar chemists and the development of the sugar industry in India opens up a new avenue of usefulness to students of the Agricultural College.

As pointed out by the Principal of the College, an analysis of the applications for admission shows that most of the students are connected by close ties with the land; of the 58 admitted this year 14 state that their object in coming to the College is to fit themselves for the management of their own estates. Eight students have been sent by the owners of large estates who wish to employ them after they have passed out.

The Governing Body of the Agricultural College was reconstituted by Government resolution no. 81/I—487, dated the 1st April, 1921, and has met twice during the year.

The College has again been without a Professor of Agriculture during the year, the work being carried on, as in previous years, by the Principal in addition to his own duties. This unsatisfactory state of affairs will happily soon disappear. Government have arranged for the transfer to these provinces of Mr. Maya Dass of the Indian Agricultural Service, Deputy Director of Agriculture, Central Provinces, who, it is hoped, will take up his appointment as Professor of Agriculture within the next few weeks.

Arrangements were made during the year to acquire 381 acres of land for enlarging the College farm, and the acquisition proceedings though somewhat delayed are now practically complete.

The model dairy is nearing completion.

15. A committee appointed to consider the question of affiliating to the Allahabad University the Thomason College, Roorkee, and the Agricultural College, Cawnpore, has presented its report. It has recommended that the Agricultural College, besides being admitted to the teaching side of the Allahabad University, should be made over to the University to be managed and maintained by it.

This, as pointed out in an explanatory note attached to the report, will necessitate some re-organization of economic research. The Committee have recommended that the teaching staff of the Agricultural College should be separated from the research staff as a necessary consequence of the association of the College with the University. This has been regarded as inevitable by the Agricultural Department for some time past but has not hitherto been possible owing to the impossibility of recruiting the necessary staff.

The present arrangement whereby the scientific officers are responsible for two distinct branches of work, to the Governing Body for teaching in the College and to the Director for research, cannot be regarded as satisfactory either from the point of view of research or teaching.

As pointed out in the preceding paragraphs, the advancement of agriculture depends on research and experiment; and it is impossible to contemplate the cessation of research on the improvement of important crops. It has been suggested that in the re-organization, which will follow affiliation, research work dealing with general problems should be continued at Cawnpore in laboratories of the Agricultural College, assigned to expert officers of the department by mutual arrangement with the University, and that some officers such as crop specialists should be provided with small research stations and laboratories situated in tracts where the crop under investigation is an important one.

Agricultural School.

16. There is a demand in these provinces for two distinct types of agricultural education. The first is a course of University standard such as that given in the four years' diploma course of the Agricultural College which will ultimately become the degree course of the University. The second is a type of education which combines school work with vocational training in agriculture. A course of this kind has been given since October, 1914, in the two years' vernacular course at the Agricultural College. It has become very popular and is evidently meeting the needs of a large and important section of the community. It is not, however, the kind of work for which the costly equipment and staff of a University are required and can be carried out equally satisfactorily, and much less expensively, at agricultural schools.

As will be seen from the preceding paragraphs, the number of applications received for the two years' course at Cawnpore indicates that there is sufficient demand for more than one of these courses in the provinces. The Agricultural School at Bulandshahr has been established in the first place to meet this demand, and ultimately when the Cawnpore College becomes a college of the University; to take over completely the school classes.

Expert opinion is by no means unanimous regarding the lines on which agricultural schools should be developed. It is probable that experience will suggest modifications of the course at the Bulandshahr Agricultural School. No good, however, could possibly result by continuing the discussion which has now extended over several years.

The course at Bulandshahr will be organized on similar lines to the two years' course at the Cawnpore College. It is intended primarily for boys who wish to take up agriculture at the end of their school life and offers a training in practical agriculture designed to be of benefit to those having a direct interest in the land. Students who have passed the two years' course of the school will be eligible for admission to the lower grade of the Subordinate Agricultural Service on the same conditions as the passed students of the two years' course of the Agricultural College. At present no educational qualification is insisted on beyond ability to read and write the vernacular fluently, but preference will be given to applicants who have passed the vernacular final or the middle standard of an English school and who can produce evidence that they intend to take up practical agriculture at the end of the school course.

The chief concern of the school will be to teach agriculture in its different branches on the school farm and the scientific teaching will be of a simple nature designed to illustrate and explain agricultural practice. The instruction will be mainly in the vernacular, but English will be taught. The course will be organized in the following groups of subjects :—

(i) Agriculture—
Lectures and practical work on the school farm of 70 acres.

(ii) Mechanical Engineering—
The use, care and repairs of simple agricultural machinery and simple workshop practice.

(iii) Elementary Science with special reference to agriculture, including Physics, Chemistry, Botany and Plant Physiology.

(iv) English.
Arithmetic.
Mensuration.
Book-keeping.

The following teaching staff have been sanctioned :—

	Rs.
Principal, U. P. Agricultural Service	(250—25—750)
Second Master	(150—10—250)
Third do.	(100—5—150)
Mechanical Instructor	(150—10—250)

Provision was made for equipment and running charges of the farm and school by a supplementary grant in July, 1921. The buildings, which were originally erected for a school of different type, are inadequate. To ensure the practical value of the technical instruction given, the school will be equipped on the scale of similar technical schools in England and America. Preliminary sanction has been given to the preparation of plans for science laboratories, workshops, class rooms, and an additional boarding-house.

To accelerate the development of agriculture in India two things urgently needed at the present time are, firstly, young men of intelligence and education willing to take up agricultural research and teaching and to adopt agriculture as a profession, and secondly, the spread of elementary agricultural education amongst the rank and file of rural workers. The essentials for enormous development exist in these provinces—an excellent soil, an industrious agricultural population and, on the whole, a not unfavourable climate—but if the development of our greatest national industry is left to the efforts of uneducated cultivators without trained direction and capable leaders, progress must be necessarily slow.

The Agricultural College and the Agricultural School provide the means of building up a sound system of agricultural education in these provinces.

Horticultural education.

17. The shortage of students in the Chaudhri and Mali classes at the Lucknow and Saharanpur Gardens continues. The Lucknow Gardens had eight and the Saharanpur Gardens five stipendiary students against 18 provided in the budget of each of the two gardens.

The question of closing the Chaudhri class at Saharanpur is under consideration.

The dearth of students in these classes is surprising, as there was a considerable demand for trained *malis*, as many as 82 enquiries being received by the department for trained men.

CHAPTER III.

Work on Principal Crops.

Cotton.

18. A notable feature in the development of cotton production in India has been the establishment of the Indian Central Cotton Committee, the formation of which was recommended by the Indian Cotton Committee.

The United Provinces Department of Agriculture is represented on it by Dr. A. E. Parr, Deputy Director of Agriculture, Western Circle, and other provincial interests are represented by the Chambers of Commerce.

The constitution of a provincial Cotton Committee to work in co-operation with the Central Committee has been approved by Government. It has been decided, after consulting the United Provinces Board of Agriculture, that the constitution of local sub-committees for special cotton tracts is not necessary at present.

The fact that the demand for cotton produced in these provinces is affected by influences prevailing outside India, added to the precarious nature of the local crop due to climatic causes, has made it in the past extremely difficult, with the meagre trade information available for guidance, to maintain and establish continuity of policy in the local department. The position with regard to cotton in these provinces is admittedly in a somewhat confused state, and reliable information regarding the probable trend of the market in India and abroad is essential. The Central Cotton Committee will be in a position to obtain this information and to supply it to provincial departments. This will greatly assist the local department in framing its future work on sound lines.

19. It is evident that the policy adopted towards cotton must rest on the acceptance of the principle that the interests of the grower and the spinner are identical. When their interests seem to differ, this fact is a clear indication that there has been an incorrect appreciation of some of the factors of the problem, and further enquiry is essential and urgent.

One point on which information is urgently needed is regarding the demand for the coarse short-stapled cotton produced in the western parts of the provinces, chiefly in the unirrigated part of the dry districts of Aligarh, Etah, Muttra and Agra. It is well-known that, as a result of the investigations carried out in the Western circle, a type of cotton, known as Aligarh white-flowered, was obtained, which is superior in regard to yield, ginning percentage and colour, but not superior in staple to the ordinary cotton grown by the cultivator in the above-mentioned tracts. It undoubtedly has given, and still gives, a larger financial return per acre than any cotton previously grown in those parts. It has been taken up widely by the cultivators, who have benefited greatly by its introduction.

The present position is this. On the one hand, it has been stated that this cotton is of little or no value to the local spinning industry. Exception has been taken to the time and effort the department has spent in providing the cultivator with the means of growing a heavier yielding variety of short-stapled cotton. On the other hand, agencies exist which are ready to buy this cotton and the cultivator finds it profitable to grow it. This appears to be a case in which the interests of the grower and the spinner do not coincide. Full enquiry is necessary to ascertain the true position. This may reveal the fact that the two interests are identical, if considered from the broader point of view of the world's demand for cotton. It must be remembered in this connection that the United Provinces purchases of cotton are not large enough to control the United Provinces cotton market.

The demand from zamindars and cultivators in the dry tracts of the western districts for assistance in procuring a supply of seed of Aligarh white-flowered cotton is so insistent that it cannot be ignored by the Agricultural Department which would be unjustified in taking steps to make the cultivator grow any variety of cotton except that which pays him best under local conditions. The latter are such in the parts where this cotton is popular as to preclude the introduction of American cotton, except on a limited scale, and confine the choice to a plant possessing the special agricultural features of Aligarh white-flowered cotton. At the present time the choice seems to lie, in these districts, between this cotton or no cotton at all.

There is reason to believe, on high commercial authority, that there will always be a certain demand for the type of cotton represented by Aligarh white-flowered in the world's market. The department has been on sure ground in assisting the cultivator to improve his yield in places, for which a more suitable type of cotton has not yet been evolved, and where it is certain no other can be grown at present with greater profit.

The note of warning, which has been sounded by the trade, requires, however earnest attention. It is incumbent on the Agricultural Department to limit its efforts to assist the growth of Aligarh white-flowered cotton to the tracts

mentioned, and to take steps to see that it is not spread by departmental agency to tracts where a superior variety of cotton is produced. The department must also keep itself closely informed of trade developments, and ascertain, as far as possible, to what extent the existing demand is likely to remain permanent.

20. There are great possibilities for the extension of the area of good-stapled cotton in the canal-irrigated tracts of the provinces. The efforts of the department to evolve improved strains, and to increase the area under staple cotton, have continued. In order to obtain results within a reasonable time it is essential to leave no possible line of attack unexplored. The activities of the department in the direction of cotton improvement, which will be found recorded in detail in the appendices to this report, have been extended during the recent years, and include the following :—

(1) Mendelian studies on the cotton plant.
(2) A botanical survey of the indigenous cotton of the provinces.
(3) The field trials of new varieties on an improved system.
(4) The extended trial and distribution of K. 22.
(5) The distribution on a large scale of pure seed of selected Cawnpore-American varieties and of selected indigenous varieties with superior lint, such as Jn. 1.

21. The cotton survey, recommended in paragraph 61 of the Cotton Committee's report, was commenced in the cotton season of 1919 by the botanical section. It was placed in charge of Mr. Youngman, Economic Botanist.

With a temporary staff of four assistants to supplement the permanent staff of the botanical section, a complete survey of the cottons of the Moradabad district has been completed. An account of this work is published as an appendix to this report. In the season 1920-21 the survey was continued in the Saharanpur district, and about 900 samples were collected. Some of these were found to possess lints of excellent quality, and about 500 samples are being grown in the botanical area at Cawnpore for systematic analysis and selection.

The cotton research farm at Raya, in the Muttra district, is now fully equipped and in working order. It will serve as a centre for the study of cottons in this tract. This year 48 acres of new cottons are under trial at this farm—approximately one-half under Pusa American type, and the remainder under K. 22.

The appointment of a Botanist for the special study of indigenous cottons has been sanctioned.

22. The distribution of American cotton, known as C. A. 9, was continued, and special irrigation facilities were provided by the Irrigation Department. This variety of cotton has to be sown on irrigation, and owing to a shortage of water at the time of sowing, a smaller area was sown in the year under report than in the previous year. The actual area was 5,380 acres as compared with 8,100 acres in the previous year.

The cultivation of American cotton has been taken up with success in the Sikandra Rao tahsil of Aligarh district. This is the only part of the Western circle in which American cotton has done well, and there is a prospect of a compact area being brought under it during the coming season. Efforts will be made to organize a market for it.

A very promising feature in connection with the introduction of American cotton is that the market for it is now established in Cawnpore, and the prices offered are independent of *deshi* cotton. The market for American cotton is liable to less violent fluctuations than other classes of cotton ; and last year cultivators of American cotton obtained about Rs. 4 per maund for their *kapas* over the price ruling for *deshi* kapas.

The demand for Jn. 1 continued and it was distributed in Hardoi, Unao, Banda, Hamirpur and Jalaun. In this variety the department possesses a cotton which has been favourably received by spinners ; and the spread of it in areas for which it is suitable should go far to assist the mills to meet their needs locally.

K. 22 was grown on departmental farms and distributed to cultivators in the neighbourhood of the Raya Farm.

23. Although there is scope in many directions for a section of Economic Entomology in the department, the appointment of an Entomologist, which was

made during the year under report, is specially important in connection with the cotton crop.

The need for entomological work on the pests of this crop was referred to by Mr. Hailey in the annual report for 1918, and he drew attention to the damage done by pink boll worm. For the present the chief work of the Entomologist will be to investigate the insect pests of cotton with the object of initiating control measures.

Sugarcane.

24. The technical problems connected with the improvement of sugarcane are less complex than those connected with the improvement of cotton, although there are certain difficulties, due to the situation of the provinces outside the tropics and to economic causes.

This crop, except for an inappreciable proportion, from which sugar is made by modern factory methods, is worked up into a marketable commodity and disposed of locally. The main product is *gur*, and the price of this depends on internal supplies and quality. The cultivator is, therefore, able to gauge the trend of the market and to form an opinion of the probable value of his crop.

25. Two-thirds of the sugarcane are produced from three well defined areas, with characteristics of their own. These are:—

(1) the Meerut division, where the highest quality of eating *gur* is produced, for which there is always a great demand at high prices;

(2) the Gorakhpur division, where a poorer quality *gur* is produced; this tract provides much of the material used for refining by the factories in Cawnpore;

(3) the Rohilkhand division, where *rab* is the main product, and where small crops of cane giving a juice of good quality are grown, for the most part without irrigation.

The United Provinces alone have an area under cane which would place them in a leading position as a sugar-producing country if the yield and quality of the cane were comparable to those of other sugar-producing countries. The area under cane for the five years ending 1918-19 was 1,336,854 acres, and the average yield of *gur* 0·94 ton per acre. The area under cane in Java in 1918-19 was 339,670 acres, and the average yield of raw and refined sugar 5·15 tons per acre.

The work which has been carried out at the experimental farms in the provinces has shown that at least 25 tons of good quality cane can be grown at a cost of approximately six annas per maund of cane. Much higher yields have been obtained at individual farms.

Actual figures for the cost of producing cane in Java and India are as follows:—

Java	4·7 annas per maund cane.		
United Provinces	5·7	ditto	ditto.
Bombay	5·7	ditto	ditto.

When these figures are considered, in connection with the fact that these provinces possess the advantage over other cane-growing countries of a local market for an enormously increased production of *gur* and sugar, and that a maund of cane yields a quantity of *gur* worth 16 annas at the prices prevailing in the United Provinces in 1920-21, it is unnecessary to dwell on the scope that exists for development.

26. In spite of the very definite results that have been obtained for a series of years at the experimental farms, it must be admitted that the area of cultivator's cane, influenced by the department's activities, is small in comparison with the areas of wheat and cotton.

27. The report of the Indian Sugar Committee has been received. The conditions in the United Provinces were investigated closely, and the report contains much that is of local interest and value.

The Committee approved of the general lines on which work on sugarcane was proceeding in these provinces, and made important recommendations regarding its expansion. Financial considerations may make it impossible to give immediate effect to all these, but the conclusions, which the Committee have arrived at, will form the basis for a sound policy in connection with sugar.

One of the main points on which stress was laid was the need for the demonstration of improved methods of cultivation on the cultivator's own land.

The general work on demonstration will be dealt with in the succeeding chapter, but it may be mentioned here that the increasing activities of the department in this direction, during the year under report, are meeting the recommendations made on this point.

28. The department possesses a wide range of canes available for distribution. These include imported canes which have proved suitable for intensive cultivation under the conditions of soil and climate prevailing in Upper India. Amongst these may be mentioned M. 16, J.247 and the varieties selected at the Sugarcane Research Station, Shahjahanpur; of the latter a selection known as S. 48 possesses the most attractive characters.

A careful survey of the canes of the important cane tracts has shown that some of these possess marked superiority over others. Pure line selections of the best canes, so far noted, have been made at experimental farms, and are being distributed. These include *saretha* in the Meerut division, *reora* in the eastern districts, and *rukra*, an early-ripening cane with a pure juice, in the Rohilkhand division.

The seedling canes, produced at the cane-breeding station in Madras, are undergoing careful trial and investigation at the Shahjahanpur research station. A regular supply of seedlings is received, and systematic methods have been worked out for multiplying the setts of these, and testing them for ripeness, yield and sugar content.

The seedling canes so far investigated possess remarkable vegetative vigour, but on the whole the quality of the juice is inferior to that of the best indigenous and imported varieties. There are a few exceptions to this, and these canes are being grown on an extended scale. Last year seedling canes were tried on a sufficiently large scale to enable several tons of cane to be crushed, and the juice of each variety separately made into *rab*, the latter being valued and analysed.

29. Better varieties alone are not sufficient to secure an effective response to the department's efforts to increase the outturn of sugar. Facilities for intensifying the cultivation and the working up of the crop require attention.

In the first place an assured and regular supply of water is required to carry the crop over the difficult months of April, May and June, when the young plant is struggling against adverse climatic conditions. Intensive cane cultivation is at the present time most successful on land commanded by tube wells and pumping plant, where the supply of water is under control, and where it can be applied at the exact moment it is required.

The area served by the proposed Sarda canal offers an unrivalled field for the improvement of cane cultivation, if suitable measures are taken to supply concentrated areas of cane with special facilities. This should present no difficulty if it is taken in hand from the beginning. The Sarda Canal will irrigate a tract of country the soil of which is specially suitable for the introduction of improved methods of cane cultivation, and in which the principal industry is already the manufacture of *gur* and *rab*, but where the cane crop is subject to heavy losses from drought and, owing to the lack of irrigation facilities, the yield of cane is inferior to that of the Meerut division and the profits from its cultivation smaller. The provision of a perennial water-supply will enable better varieties of cane to be substituted for the inferior varieties, such as *dhaul* and *chin* at present grown, and should also lead to a very marked improvement in methods of cultivation.

30. It has been estimated that, if the entire cane crop of India were crushed in modern mills and worked up in central factories, an increased production of over one million tons of sugar would result.

It is hoped, and indeed it may be regarded as probable, that the profits that can be made by manufacturing white sugar direct from cane in central factories will lead, in the near future, to an increase in the number of these in the United Provinces. At the same time it is certain that a large proportion of the cane crop will always be made into *gur*. The immediate practical problem before the department in these provinces, and to which attention has been already given, is to introduce power-driven machinery for crushing cane on a relatively small scale for the manufacture of *gur*. The two agricultural operations which make the

heaviest demand on the bullock power of the country are the crushing of the cane crop and the threshing of the rabi crop. Both these operations can be effectively carried out by power-driven machinery, and its introduction presents fewer difficulties than most changes in Indian agriculture.

The deterioration of the cattle, in consequence of the heavy demands on them during the cane-crushing season, is great, and there is no doubt, if it could be expressed in terms of money, the figure would be a high one.

Small power-driven mills have been successfully worked at the experimental farms for a number of years. These varied in size, the smallest crushing 15 maunds of cane per hour, and the largest 54 maunds of cane per hour. From indigenous canes the amount of juice obtained is 55 pts. per 100 of cane.

During the year under report a small power crushing mill was worked in the Muzaffarnagar district by the Agricultural Engineering Section. The cultivators brought their cane to the mill for crushing, and boiled down the juice to *gur* in their own furnaces. The plant was working under experimental conditions, and final figures as to the cost of crushing have not yet been obtained.

The delicate financial balance under which agricultural operations have to be conducted in India, leaves only a small margin for variation between the cost of power crushing and crushing by the present method of bullock-driven mills. A full examination of the existing data shows that the cost of crushing cane in small power mills and manufacturing *gur*, including all charges, such as interest, depreciation, renewals and supervision, should be between two and three annas per maund of cane crushed.

The experimental sugar factory at Nawabganj, Bareilly, was carefully examined by the Indian Sugar Committee, who visited it on 3rd November, 1919 and on 18th July, 1920. They report that, in spite of the excellence of its design and equipment, it is unsuitable for the purpose for which it was erected, and recommended that it should be disposed of. They deprecate the disposal of it as working concern as it stands, and suggest that such parts of it as are of standard pattern should be sold to existing factories. The sanction of Government to carry these recommendations into effect has been received.

Taking all the factors existing in these provinces into consideration, the best solution of the problem of working up the cane crop into *gur* will probably be the introduction of small power mills, capable of crushing about one ton of cane an hour, combined with the boiling of juice in the Rohilkhand Bel, adapted for producing *gur* instead of *rab*.

31. In the Saharanpur district, where considerable areas of intensively cultivated thick and medium canes are grown, the crop was badly damaged by an outbreak of red rot (*Colletotrichum falcatum*). The department was able to organize a supply of resistant varieties of cane, and is initiating preventive methods to cope with the disease.

Wheat.

32. The cultivation of better yielding varieties of wheat has been permanently established in the United Provinces. It may be regarded as the most successful and definite result that the Agricultural Department has obtained.

The area under wheats, introduced by the department, was estimated by my predecessor, Mr. Hailey, at 100,000 acres in 1916. and at 250,000 acres in 1918. The area has now reached a figure at which accurate estimates cannot be made by departmental agency, but it cannot fall far short of four hundred thousand acres.

The Agricultural Department was fortunate in the early days of its development in obtaining Pusa wheats, which are admirably suited to the local conditions, and the Provinces owe a debt of gratitude to Mr. and Mrs. Howard, the Imperial Economic Botanists, Pusa, who introduced them.

The wheats give an increased yield, when grown under the cultivator's conditions, but their main characteristic is their power to respond to better treatment. This fact is now recognized by cultivators, and is acting as a great stimulus in promoting improved cultivation.

The largest yield, hitherto recorded, was obtained last year, viz., 37 maunds per acre. During the harvest of the year under review the wheat crop, in many districts, was damaged by early and continuous west winds during the ripening

period. This resulted in a much diminished yield of grain, and it is worthy of remark that Pusa 12 gave a fair yield of grain in tracts where other varieties yielded scarcely any.

The work of the department in connection with wheat has, as in former years, consisted in maintaining a supply of pure seed from seed farms and seed dépôts. The latter are almost entirely stocked with Pusa wheats. During the year under report 39,560 maunds of wheat seed was distributed to cultivators.

A steady and constant supply of new wheats, produced at Pusa, is being received and tested at the experimental farms. Some of these have given results which warrant their trial on an extended scale during the coming year. Pusa 12 and Pusa 4 have become so firmly established that it is not desirable to replace them by general distribution of other varieties, until the latter have proved that they possess definite points of superiority.

Other crops.

33. It must be remembered that systematic work, such as that reported under cotton, sugarcane and wheat, requires a whole time specialist officer for each crop or group of crops. Work has been continued on other crops during the year under report, but by officers already more than fully occupied by other duties.

Flax.

34. The shortage of the supply of flax during the war, and the abnormally high prices to which it rose, drew attention to the possibilities of its production in these provinces. Enquiry showed that a potential area for this crop exists in the tarai and experiments were started on the Tarai and Bhabar estates. These have been continued, but were handicapped by the lack of trained men.

Arrangements have been made for sending a member of the Subordinate Agricultural Service to the Dooriah Factory in Bihar for a year to learn methods of flax growing and the processes of retting and scutching.

Oilseeds.

35. A collection of tils (*sesamum indicum*) was made by the Economic Botanist and a preliminary classification carried out. A collection of castors from Bundelkhand was also made with a view to selecting a type with high oil yielding properties.

Potatoes.

36. The study of potato storage rot was commenced by the Plant Pathologist.

37. Selected varieties of gram, *arhar*, *juar*, barley, groundnuts and maize were distributed.

CHAPTER IV.

Assistance to the Public.

Demonstration.

38. During the year under report the Agricultural Department has devoted increased effort to what must be regarded as one of its fundamental duties, viz., demonstration on the cultivator's own land, of methods worked out at the experimental farms.

The selection of superior varieties of crops, the distribution of seed of those varieties, and even the extension of irrigation facilities, will not lead to the results that should reasonably be expected of them, unless accompanied by a vigorous campaign of instruction in the villages.

The work has hitherto been retarded by several factors. In the first place, as pointed out in preceding paragraphs, it was necessary to work out methods and thoroughly test them before introducing them into general practice, and secondly, trained men, capable of carrying out this difficult work, have not been available in sufficient numbers. Demonstration work requires the highest agricultural qualifications. Indifferent work, by an insufficiently trained man, may retard progress in a locality for years.

The difficulties are disappearing, and, with an increased staff and better facilities, which now exist for training them, the department has been able to take up demonstration on an extended scale.

Attempts to introduce methods, which require a complete change in existing agricultural practice, are foredoomed to failure. The permanent improvement of agriculture must be built up gradually on the present system. Attention is drawn

to the simple improvements described in Appendix I, which have been demonstrated in the Western Circle, and which have had a marked effect in increasing the outturn.

One of the best examples of the advantage derived from very simple modifications of existing practices is given by the results obtained by sowing early cotton in rows 20 inches apart instead of broadcast. It is easily done without extra cost by dropping the seed in a furrow behind a country plough, every alternate furrow being left unsown. The demonstration was carried out in 12 villages. The average outturn of *kapas* per acre, sown in lines, was 7·54 maunds, and the average outturn of *kapas* per acre, sown broadcast, was 5·50 maunds.

The advantages of the method are :—

(1) more regular germination is obtained ;
(2) the crop can be intercultivated with bullock drawn implements ;
(3) the crop sown in lines resists drought better ;
(4) the yield of *kapas* is greater;
(5) the harvesting of the crop is more easily done ;
(6) the cost of sowing is not increased.

Dr. Parr reports that the cultivators are convinced of the extra profit which results from this method of sowing. There are 200,000 acres of early cotton in the Western circle to which it can be applied.

It is important in a country where the amount of moisture in the soil is always a matter of anxiety, and frequently a limiting factor in crop yield, to develop every possible means of conserving both the natural moisture and that supplied by irrigation. The Indian cultivator is good at retaining the moisture in the soil up to the time of sowing the crop ; but with the country plough and wooden beam the methods of cultivation followed are slow and laborious.

In seasons of deficient rainfall valuable moisture is often lost before the land can be properly cultivated, owing to the fact that the *ryot* does not possess suitable harrows and light cultivating implements. The want of these also prevents the cultivation of the land during the early stages of the crops' growth, which is a prominent feature of the agriculture of other countries. This is particularly essential in India where irrigation is generally practised, and the fact that it is not carried out extensively accounts, in a large measure, for the excessive amount of irrigation water that is considered necessary, and it certainly results in a great loss of water.

The account given by Dr. Parr of the demonstrations that have been made on the harrowing of wheat and sugarcane on a large scale marks a distinct advance in the agricultural practice of the provinces.

The details of the demonstration, initiated in the central circle by Mr. B. C. Burt, and continued by his successor, Mr. T. R. Low, show the actual work involved in carrying out an effective scheme. In the Central Circle there are 25 travelling agricultural assistants with fieldmen and trained labourers. During the year 2,554 demonstrations of improved methods were made in the Central Circle over a total area of 24,044 acres, of which 15,059 acres were under wheat and 4,199 acres under cotton. Demonstration was carried out in 11 districts in the circle, and, in order to economise the time of the staff, the work was grouped around convenient centres. The work done by this staff during the year is reported to be the maximum possible. The figures enable an idea to be formed of the scale in which operations will be necessary to produce a noticeable effect on the 34 million acres under cultivation in these provinces.

Private farms.

39. The number of private farms established by zamindars and landholders on their *khudkasht* or *sir* land, and worked on lines suggested by the department, is now 202. They vary in size from 10 to 250 acres.

The idea of private farms was first developed by Mr. Sharma in the Eastern Circle, which includes the province of Oudh, where the conditions are very favourable for them; and 65 have been established by departmental agency. They are extending rapidly in the Central Circle, and the number increased from 60 to 124 during the year. The greatest increase

was in the Cawnpore district, where the number rose from 9 to 39. The financial results of some of them are given in Appendices II and III. The farms are a paying proposition. One complaint was received of failure. It was investigated, and a critical examination made of the facts on which the statement was based. Steps have been taken to remove the cause of failure and to place the area of land acquired under competent management. The farms are started without expensive equipment. Mr. Sharma has supplied the figures of the capital outlay on three small areas of land in the Lucknow district, which are under his supervision, together with the working expenses (including rent) and the receipts, which are given below:—

	Rs.
I.—Basha, area 16·5 acres—	
Capital expenditure	1,930
Working charges, 1920-21	1,012
Receipts, 1920-21	1,490
Net profit	478
II.—Qabulpur, area 18·75 acres—	
Capital expenditure	650
Working charges, 1920-21	800
Receipts, 1920-21	2,500
Net profit	1,700
III.—Kanosi, area 18·15 acres—	
Capital expenditure	380
Running charges, 1920-21	1,038
Receipts, 1920-21	1,743
Net profit	705

The Macha farm of 40 acres in the Cawnpore district showed a profit of Rs. 1,108 on a working expenditure of Rs. 2,735.

The private farms fulfil very useful functions, and are of assistance to the department in many ways, notably in demonstration work and the production of seed. Each farm serves as a seed dépôt and as a centre from which improved methods spread to surrounding cultivation.

Seed depots.

40. Seventy seed dépôts, supervised and controlled by the department, were worked during the year. They were distributed amongst the circles as follows:—

Central Circle	23
Western Circle	12
Eastern Circle	32
North-Eastern Circle	3

The total amount of seed distributed was 56,315 maunds—the largest on record. The distribution in different circles was as follows:—

	Maunds.
Central Circle	28,689
Western Circle	8,255
Eastern Circle	18,022
North-Eastern Circle	1,349

The seed distributed consisted of chiefly wheat, cotton and sugarcane. The figures are as follows:—

	Maunds.
Wheat	39,560
Cotton	3,799
Sugarcane	9,560
Miscellaneous *rabi* and *kharif* crops	3,396

In addition to these every private farm and demonstration area acts as a seed dépôt and there were known to exist in the provinces 272 centres from which pure seed of varieties, recommended by the department, could be obtained.

The seed dépôts are financed by permanent and temporary advances, the accounts of the former being audited by the Auditor of Public Funds Accounts. Seed is sold at the dépôts of the Central, Western and North-Eastern Circles on direct cash payment, or advanced on a cash basis, charging ordinary taqàvi rates of interest. This is found a more convenient business method than the prevailing *sawaii* system. In the Eastern Circle approximately 80 per cent. of seed is sold on the grain *sawaii* system, and Mr. Sharma reports that this system is preferred

by the customers of the dépôts, and is regarded as a favourable rate. The purchase of seed at market rates at harvest and selling it at market rates at sowing time is, in most seasons, the more profitable form of business for the dépôts.

The report of the seed dépôts of the Eastern Circle is given in Appendix IIIA and contains interesting information regarding their work. The expenses including the pay of staff are borne by the dépôts themselves, and a clear profit of Rs. 14,585 has been realized on the temporary advances alone.

It may be regarded as established that the agricultural seedman's business is a very profitable one, and has justified the financial assistance which has been given to it by Government in the form of permanent and temporary advances. It seems desirable now to finance it entirely by permanent advances, audited by the Auditor of Public Funds Accounts. The time has also arrived when efforts should be made to encourage private enterprise to take up the work.

The Agricultural Department recognizes that one of the aims of its organization should be to place, within reach of every cultivator in the provinces, pure seed of varieties of staple crops, better suited to local conditions than those at present grown. It is not necessary to point out that the problem is an immense one. It can only be solved by co-ordination of effort, and it must be acknowledged at once that governmental agency, unaided by private enterprise, cannot hope to solve it satisfactorily in a reasonable time.

The agencies which must be looked to for the solution of the problem are :—

(1) The Agricultural Department.
(2) The Department of Co-operative Societies.
(3) The establishment of seed stores by private land-owners and others.

The selection of better varieties of crops and the production of a large amount of the seed of such crops at seed farms are primarily the work of the Agricultural Department. It is also the work of that department to ensure that all seed sold to cultivators is properly grown and fit for distribution. The production of new varieties entails a vast amount of scientific research of the highest order, and it is for this reason, amongst others, that experimental farms are a necessity, as pointed out in chapter I. The discovery of new and better varieties must precede the organization of seed supply.

The work of distribution is the joint concern of the Agricultural and Co-operative Departments. In the past the work of seed distribution has been done mainly by the Agricultural Department, but as the magnitude of the task became apparent, and it was found that the organization of an adequate seed supply for the provinces was beyond the capacity of the Agricultural Department, the Co-operative Department has come forward, and is, year by year, taking an increasing part in the work of distribution.

Private enterprise has done something—but much more remains to be done, if a really efficient seed supply organization is to be built up. Recently there has been evidence of a desire on the part of land-owners and others to take up the business of growing improved seed and selling it to their tenants.

Agricultural engineering.

41. As in the case of seed supply, the Agricultural Department undertakes, by means of its engineering section, work which, in other countries, is carried out by commercial firms.

The trade organization that is required to enable private firms to keep in touch with their customers and to deal directly with zamindars and cultivators, does not exist. Government possesses an organization which can be utilized without incurring additional expense, and moreover the work carried on by the Agricultural Engineering Section is of such importance to the economic development of the provinces, that the responsibility of initiating development on right lines must be accepted by the Agricultural Department.

The expansion of the staff of the engineering section, which was sanctioned during the year, has provided means of increasing the assistance given to zamindars. The appointment of three Assistant Agricultural Engineers has made it possible to organize a scheme for rendering assistance and advice in districts more accessible, besides providing for increased constructional work.

The necessity for a district engineering staff, for the regular inspection of the machinery given out by the department, to give instruction in its use and to

arrange for simple repairs has long been felt; and although the complete organization proposed is not yet possible, a beginning has been made.

Four engineering circles have been started with headquarters at Cawnpore, Bareilly, Meerut and Partabgarh, and at each of these an Assistant Agricultural Engineer will be stationed.

The district well boring staff, which during the year has consisted of 33 borers, was placed under the Agricultural Engineer in June, 1921, and is thus subject to expert control and systematic inspection and check.

The number of wells bored during the year was 746, of which 513, or 68 per cent., are stated to be successful; 131 sites for new wells were bored, and 84, or 64 per cent., were returned as successful.

There is a continued demand for tube wells and pumping plant. The rise in prices of all engineering material has had some effect on the rate of development, and the uncertainty of the industrial situation makes it impossible to give estimates with any accuracy. Twelve tube wells were taken in hand during the year, and there were enquiries for over 150. When the equipment, for which funds have been sanctioned, is obtained an increased output will be possible.

The demonstration tube well at Taleora, in the Hardoi district, was worked departmentally during the year, the area irrigated was 213 acres, and the profits after paying all expenses Rs. 287. Another well at Gopar irrigated 300 acres of rabi and 40 acres of kharif.

The building of the workshop, for which funds have been sanctioned, has been delayed owing to the land required not being available.

Agricultural shows.

42. Twenty-four agricultural exhibitions were held during the year, at most of which demonstrations of machinery and implements formed part of the programme.

Implements.

43. There was an increased demand for these in spite of the high prices prevailing; the chief demand being, for ploughs, 109. Meston ploughs were given out in the Western Circle and a total of 1,141 implements in the Central Circle.

CHAPTER V.

MISCELLANEOUS.

Baisurai.

44. An interesting series of experiments* has been carried out at Agra and Aligarh on the use of Baisurai (Pluchea Lanceolata) as a fodder.

Baisurai is a well-known weed in the Agra division and there is a continuous stretch of country, estimated at one million acres, in Aligarh, Muttra, Agra and Etah, thickly infested with it. It also occurs in Jaunpur and Benares where it is known as Roshna. It is characterised by a vigorous growth during the hot weather months of April, May and June, and its roots often penetrate to the permanent water level. In the early stages of growth Baisurai is a succulent plant, but the fact that cattle grazing in a field full of it carefully avoid it, led to a general impression that it was actually injurious.

Experiments were started at the Agra and Aligarh farms to see if it could be utilized as fodder, and they have shown that green Baisurai can replace half the total fodder required by working bullocks. The bullocks were gradually accustomed to it by mixing an increasing quantity with their other fodder, until after a few days half the daily ration consisted of green Baisurai.

The experiments at Aligarh indicate that a ration of one half green Baisurai and one half *juar* stalks gives better results than a full ration of *juar* stalks alone.

The important point is that the use of it can effect a saving of 40 maunds of *juar* stalks or *bhusa* per head of cattle during nine months of year, September to June, in a tract of country where fodder scarcity is an almost chronic condition. In the Baisurai tracts of Aligarh, Muttra, Etah, and Agra there are 150,000 working bullocks, which are fed mainly on *juar* stalks and *bhusa* fodder. If use were made of Baisurai, a saving of 6,000,000 maunds of other fodder could be effected; this is more than the amount introduced during the severest fodder famine. It is clear that a fodder reserve of great value exists, and it is important

*A detailed description of these experiments is given in the Annual Report of the Farms of the Western Circle, 1920-21.

that steps should be taken in normal times to familiarize cultivators with this means of supplementing their supply. It is useless waiting until fodder famine conditions exist and then to advocate suddenly the use of an unfamiliar form of fodder, of which the cultivator has no previous experience. A certain amount of demonstration has been carried out, but it was not found possible to provide funds for systematic demonstration in villages.

Cattle-breeding.

45. In accordance with the instructions contained in G. O. no. 207C., dated the 25th March, 1920, Mr. C. H. Parr collected during the year the necessary material for determining the organization and staff required to develop cattle-breeding operations as an independent section of departmental work. He prepared two comprehensive schemes, which were considered by the Board of Agriculture on the 21st of May, 1921 and the 12th of August, 1921.

The proposals were made on the assumption that one of the two existing cattle farms, viz., that at Madhurikund in the Muttra district, would be retained by the Civil Veterinary Department, and they included, therefore, provision for a new farm to meet the requirements of Hariana cattle. This involved a large capital expenditure, which at the lowest estimate could not be reduced below Rs. 3·37 lakhs. In view of the financial situation it was felt by the Board that this additional expenditure could not be recommended when a cattle farm of 600 acres already exists, which has been proved by experience to be admirably suited to Hariana cattle.

The Board, therefore, recommended that both the Majhra farm in Kheri and the Madhurikund farm in Muttra should be placed under the Agricultural Department and put in charge of the Deputy Director in charge of cattle-breeding, and that the question of opening another farm be postponed.

Expenditure and receipts.

46. The total expenditure of the department was Rs. 14,63,199 compared with Rs. 9,90,814 in the preceding year. The receipts amounted to Rs. 1,68,153 against Rs. 1,61,148 in the previous year.

I have the honour to be,

SIR,

Your most obedient servant,

G. CLARKE,

Officiating Director.

APPENDIX I.

Report on the Administration of the Western Circle of the Agricultural Department, United Provinces, for the year 1919-20 *by* A. E. PARR, ESQ., B. SC., PH. D., M.A., M. S. *Deputy Director of Agriculture.*

I was in charge of the circle throughout the year under report.

The circle consists of 18 districts (Dehra Dun, Saharanpur, Muzaffarnagar, Meerut, Bulandshahr, Aligarh, Bareilly, Bijnor, Budaun, Moradabad, Shahjahanpur, Pilibhit, Almora, Garhwal, Naini Tal, Muttra, Agra, and Etah) and has the following farms :—

Name of district.	Where situated.	Area in acres.
Aligarh	1. Aligarh	88·24
	2. Kalai	166·38
Bareilly	3. Nawabganj	117·0
Agra	4. Bichpuri	109·0
Muttra	5. Jachonda	55·86
Bulandshahr	6. Bulandshahr	25·0
Saharanpur	7. Saharanpur	38·75
Muzaffarnagar	8. Muzaffarnagar	109·0

The experimental work done at each farm is detailed in the Annual Report of the Agricultural Stations of the circle.

Demonstration Staff.

All staff which could be spared from Farm work has been concentrated on district demonstration work. In the Etah district an experimental beginning in building up a definite and organized demonstration staff was made. A senior member of the Subordinate Agricultural Service was placed in charge of the work. Under him five fieldmen were stationed at suitable places throughout the district and each fieldman had a certain number of Kamdars or trained labourers to assist him.

A similar organization was started in the Aligarh district on a smaller scale. The staff remains out in the district the whole year. The results obtained up to date by this organization are very encouraging.

The Fieldmen and Kamdars are closely in touch with the cultivators and a large number of local demonstrations are possible. Local demonstration of a new thing on the villager's own land is the quickest way to convince him of its value.

Seed distribution.

Wheat.

Pusa 12 had a very successful year. Hot winds blew continuously at the end of March and in early April. The result was that in late ripening varieties of wheat the grain shrivelled up. Pusa 12, which ripens several days earlier than the average variety, gave a fair yield of grain in many tracts where other varieties yielded scarcely any. The result is that Pusa 12 has become more popular than before. The area goes on increasing with little assistance from the department. There will probably be a very large increase in area next season owing to this year's good results. The total amount of wheat seed supplied to indentors this year was 2,709 maunds. Most of this was Pusa 12.

Pusa 12, although it has done better than local varieties over a series of years in many parts of the Western Circle, is by no means the last word in wheat. The cultivator really wants an awned variety with the early ripening and high-yielding characteristics of Pusa 12.

The total area under Pusa 12 in this circle is now estimated at about 100,000 acres. Small quantities of other varieties of wheat were distributed.

Cotton.

Aligarh white-flowered cotton retains its popularity in spite of pessimistic prophecies regarding its future. The cultivator is still anxious to grow it and the rate in the market is still attractive as compared with prices for other cottons. No cotton has yet been found which so well suits the irrigated and unirrigated tracts of the Agra division and some neighbouring districts. The demand for seed this year was much greater than could be met. Arrangements are being made to carry on the seed-supply on a more extensive scale as was done a few years ago. There are about 150,000 acres of this variety of cotton now growing in the Western Circle but a lot of this is no longer a pure crop. In order to keep the crop pure a continuous supply of carefully selected seed must be distributed every year as there are in every district a large number of growers who depend upon others for their cotton seed. When sowing time comes they are not always able to get good, pure seed and frequently have to sow any mixture they can get.

The Sikandra Rao tahsil of the Aligarh district and the neighbouring part of the Etah district is the only tract in the Western Circle in which American cotton has up to the present shown promise of success. Special efforts are being made to get out a compact area in this tract and to organize a market for it. Several hundred acres have been sown this year. K-22 has done well on some of the experimental farms this year but further study of this variety is necessary before it can be safely given to the growers in the districts. In dry season it does not germinate as well as the ordinary local cottons. Also it requires a somewhat longer growing season but if it maintains its lint characters there are probably irrigated tracts in which it will prove a paying crop.

Sugarcane.

Five thousand one hundred and sixty-three maunds of sugarcane were supplied for sowing purposes. Of this 2,057 maunds were supplied in the Rohilkhand division.

Owing to the local canes of Saharanpur suffering badly from red rot last year, it was thought advisable to give out into the infested tract varieties which had shown themselves more resistant to the disease. Eight hundred maunds of seed were distributed and small areas were sown in a number of villages. Reports up to date on the condition of these canes in comparison with the local ones are very satisfactory. Special attention is being devoted to the damage done by red rot in the Saharanpur district and it is hoped that satisfactory methods to cope with the disease will soon be available. Six hundred and seventy maunds of cane were supplied for sowing purposes from the Kalai farm. A magnificent crop of cane grown at the farm attracted a lot of attention and a number of growers indented for seed and also visited the farm to study the method of growing which they intended to adopt. A certain amount of cane from Kalai was distributed at cheap rates into the Etah district in order to give it a primary introduction into a new tract. Mauritius no. 16, S. 39, S. 44, S. 48, Saretha and Reora were the canes chiefly in demand in the circle and large areas of these varieties are now grown.

Miscellaneous seeds.

Some varieties of Pusa gram have done very well on the experimental farms and small quantities of seed are now being distributed to cultivators.

Small quantities of arhar, juar, indigo, and lucerne have been also supplied.

A detailed statement of seed supplied is given below :—

Name of place.	Wheat chiefly Pusa 12.	Sugarcane different varieties.	Cotton seed different varieties.	Miscellaneous kharif and rabi seeds.	Total.
	Mds. srs. chs.	Mds. srs. chs	Mds. srs. chs.	Mds. srs. chs.	Mds. srs. chs.
Aligarh	414 31 6	129 29 0	29 37 7	10 34 4	585 12 2
Nawabganj Bareilly	592 29 1	2,057 34 0	0 20 0	7 6 9	2,658 9 10
Budaun	196 23 6	300 0 0	1 29 0	4 29 0	503 1 6
Agra..	330 6 12	156 0 0	6 18 0	29 3 0	521 27 12
Muttra	168 23 9	206 9 6	94 30 12	1 14 7	470 38 2
Bulandshahr	311 0 0	610 0 0	9 20 0	15 5 0	945 25 0
Muzaffarnagar	341 15 0	220 22 0	2 11 14	2 1 12	566 10 10
Saharanpur	138 8 13	792 19 0	3 0 0	10 32 7	944 20 4
Kalai	90 13 10	668 14 8	92 9 5	29 14 0	880 11 7
Etah	125 12 4	22 0 0	28 21 12	4 0 0	179 34 0
Total ..	2,709 3 13	5,163 8 15	268 38 2	114 20 7	8,255 30 5

Implements and machinery supply.

The most noticeable feature of the year was a keen demand for Meston ploughs. This demand came chiefly from the Budaun and Etah districts. Concentrated demonstration work in the latter district has shown a large number of cultivators how necessary Meston ploughs are for their work and a big demand for these ploughs will undoubtedly arise. Unfortunately the source of supply has not been satisfactory this year. Owing to strikes at the works and delays on the railway great delay has often been experienced in supplying keen indentors. An attempt is being made to get local foundries interested in the making of these simple ploughs. If this does not succeed larger stocks will have to be carried departmentally or by up country agencies of the firms concerned.

Fifty-five Archimedian Screw Pumps were supplied, chiefly to the Deputy Director, Central Circle. These are now made by private enterprise in the Bareilly district and also by Government Central Woodworking Institute, Bareilly. Indentors can now obtain them direct by applying to the above-mentioned workshop. The supply of other implements calls for no remarks.

A statement giving full details of implements supplied is given below :—

Meston ploughs	109
Watts ploughs	14
Turn wrest ploughs	2
Shares for above	102
Screw pumps	55
Bullock cultivator	1
Chaffcutters	3
Parts of above	16
Tipharas	5
Levelling karhas	5
Marker	1
Bar harrow	1

General demonstration and district work.

Cotton-sowing demonstrations.

During the last year a large number of demonstrations were arranged in the Aligarh district in order to show the advantage of sowing cotton in lines as compared with the ordinary method of broadcasting. The demonstrations were confined to villages where cotton is usually sown on irrigation in May and early in June. The land was prepared in the ordinary way by the cultivators. At sowing time, instead of the seed being broadcasted over the field, it was dropped into a furrow behind the country plough. Every alternate furrow was left unsown. In this way the seed was sown in lines of about 20″ apart. Special efforts were made to keep the furrows as straight as possible.

With the crop growing in lines it was possible to do much of the weeding with bullock-drawn implements instead of having to do it with expensive hand labour.

In each village the kapas of the plots sown in lines was picked and weighed separately and for comparison's sake the kapas of a neighbouring plot sown in the ordinary way was also weighed. The following table gives the yield of kapas per acre :—

Name of villages.	Outturn per acre of cotton sown in lines.			Outturn per acre of cotton sown broadcast.			Remarks.
	Mds.	srs.	chs.	Mds.	srs.	chs.	
Aurangabad	4	30	0	3	27	7	
Chirauli	10	33	2	7	20	0	
Daudpur	9	15	0	5	30	0	
Chanrauli	4	18	7	3	10	0	
Gualra	8	20	0	7	0	0	
Shahpur	5	9	1	3	16	9	
Kalai (1)	13	3	12	8	38	2	
Do. (2)	5	12	8	5	6	14	
Do (3)	9	23	7	6	10	0	
Imalani (1)	4	20	0	5	1	4	
Do. (2)	6	30	0	6	12	8	
Chahlesar	5	15	10	5	12	0	
Machua	7	22	13	4	29	1	
Bhabbigarh	8	17	8	6	11	4	
Rahmanpur	9	32	8	4	3	12	
Average yield per acre	7	22	14	5	20	9	

It will be seen from the above table, that in 14 cases the yield of kapas in the plots sown in lines was greater than that of the plots sown broadcast. The average extra yield was over two maunds per acre, an increase of 37 per cent.

The demonstrations last year convinced the growers of the extra profit to be derived from the method of sowing. The result is that a much larger area is being sown this year.

The advantages of sowing early cotton in lines as observed by the cultivators last year are—

(1) More regular germination is obtained.
(2) The crop can be inter-cultivated with bullock-drawn implements, which saved much labour.
(3) The crop sown in this way resists drought better.
(4) The yield of kapas is greater.
(5) Picking of kapas is more easily done.
(6) The cost of sowing is not increased.

If a shower of rain falls soon after early cotton is sown a crust forms on the surface of the soil. The young cotton plant is unable to force its expanding leaves through this crust and the crop has to be resown. Slight showers at this time of year are not uncommon and frequently large areas have to be sown again. Experiments made this year have shown that this crust can be broken and the young crop saved if the field is harrowed. A simple

harrow sufficient for the purpose can be made by any village mistri at a very small cost. Harrows were eagerly borrowed from the farms this year for the above purpose.

There are two hundred thousand acres of early sown cotton in the Western Circle. All this area could with great advantage be sown in lines. By sowing in lines regular cultivation can be done. This helps the growing crop and it is also of great benefit to the crop which follows. Where canal-irrigation is available one crop follows another in quick succession. As soon as the cotton crop is off barley and peas are sown. If while the cotton is on the ground the land between the rows is well cultivated the next crop would no doubt be a much better one. Similarly as regards wheat following maize. If the maize is sown in lines and well inter cultivated the following wheat crop would be improved.

This problem of sowing crops in lines is one which deserves the attention of every thinking agriculturist in the United Provinces. Systematic drilling and interculture of some crops would probably effect as great an improvement in the local agriculture as it did in English farming two hundred years ago. Demonstrations of this nature are being carried on in several districts with cotton and maize Most of the inter-cultivation is being done with either a three-tined implement called a tiphara, drawn by two bullocks or a small type of cultivator for which only one bullock is required. Both these implements are made locally.

Sugarcane-hoeing.

One of the most difficult problems in the sugarcane-growing tract of the Western Circle nowadays is to get the early hoeings of the sugarcane done; with labour high in price and difficult to obtain, it is necessary to find a bullock-drawn implement which will do some of the work. Demonstrations of the lever harrow and spring tined harrow were given this year in various places and were particularly successful in the Etah district. After a few demonstrations the cultivators started using these implements readily. About sixty acres of village sugarcane (chin) were harrowed with the lever harrow after the first and second waterings. The work done by the harrow was very satisfactory and there was a 50-per cent. saving in labour. When the crop was about 1'-1½' high a five-tined spring harrow was used. A man with a pair of bullocks can hoe three or four acres a day. Specially made fine tines are necessary for the purpose. There are very large areas of cane which can be hoed with the above implements; they are particularly suitable for tracts where cane is sown fairly deep. Where sown shallow some alteration in the harrows will be necessary and this problem is now being studied.

Harrowing wheat.

Large areas of wheat in different districts were harrowed with the lever harrow, after the early irrigations. This operation will gradually be generally adopted if the necessary implements can be placed at the cultivators' disposal. One of the greatest defects in the present agricultural equipment of the United Provinces farmer is that he has no harrows or light cultivators at his disposal. One or two simple types of harrows would greatly facilitate cultivation. In addition to things already mentioned for which properly made harrows can be used, observations made during the monsoons of 1920 and 1921 show how useful they can be in assisting in preparing land for the rabi crops. In 1920 the monsoon gave abundant rain in July but suddenly stopped in August. Hot winds began to blow and before the cultivator was able to plough his rabi area a large part of the land got too dry and hard. The result was that where no irrigation existed thousands of acres of rabi area could not be sown. Had this land been quickly gone over with a harrow, capable of loosening four or five acres a day, the moisture would have been conserved, the ploughs would have been able to work at their leisure, and rabi sowings would in many cases have been possible.

In the present year breaks in the rains have in many cases not been long enough to allow the rabi area to be broken up in addition to other urgent work. The result is that shower after shower has fallen on a hard unbroken surface and a large amount of the water which should have sunk into the loose soil has run away. With a simple harrow the surface could have been broken up during a short break in the rains and all this valuable water would have gone into the ground where it fell.

Sugarcane cultivation.

Further demonstrations of the deep trench system of growing cane were made. This system will, I expect, be taken up wherever it is possible to grow thick canes. Bulandshahr has taken it up more quickly than other districts

Agricultural shows.

A display of agricultural machinery and produce was made at the annual fairs held at the following places:—Aligarh, Bulandshahr, Muzaffarnagar, Meerut, Batesar, Moradabad, Kakora, Khunak, and Barsua. Special efforts were devoted to making an attractive show at the district fairs and large crowds visited the agricultural sections. Particular interest was shown in the working of power-driven sugar-crushers, and motor tractors.

Bullock-driven chain pumps and an Archimedian screw driven by an engine also proved very attractive

A bullock gear was put on a small wooden truck and moved rapidly from place to place. It was shown working a chain pump, chaffcutter, and grain kibbler in quick succession and always collected a large crowd.

Baisurai.

During the year a large amount of work has been done on the weed "*Caisurai*" or "roshna", (Pluchea Lanceolata). This is a very troublesome weed in the districts of Aligarh, Agra, Muttra, Etah, Jaunpur, and Benares districts. It is a plant about

1½ to 2 feet high with a root system which goes straight down to the underground water level. Dissections made at Aligarh have in each case shown the root system as ending only when water-logged soil, at 22 to 25 feet, is reached. This weed does much damage to rabi crops especially in unirrigated areas. On account of its deep root system it grows much more quickly than the unirrigated crop and in spite of many weedings a great reduction of crop outturn is the result. After the rabi crop is harvested, baisurai grows with great vigour through the hot dry months until the rains break. It is so thick on the ground as to appear like a crop and often has to be cut by hand and carted to the side of the field, when the rains break before ploughing can begin. During the rains it grows less vigorously and does little further damage till after the rabi crops are sown. Its seed is very light and is carried long distances by the wind. In this way the weed is spreading into tracts which have up till now been free from it. The Agricultural Department farm at Bichpuri in the Agra district is right in the baisurai tract and a special study of the baisurai weed was commenced this year. Expert examination showed it contained no chemical ingredient of commercial value and it was also considered useless as paper-making material.

In its younger stages it is succulent plant and it was thought advisable to try if some use could not be made of it as cattle fodder.

Cattle grazing in a field infested with baisurai carefully avoid it on account of its unpleasant taste and cultivators freely express the opinion that it is directly injurious to cattle. In spite of this, experiments in feeding it were begun on a large scale at Agra and on a smaller scale at Aligarh. Twenty-seven animals were used for the experiment, full details of which will be found in the reports on the Aligarh and Agra farms. The experiments made at Agra lasted for nine months, viz. from September to June. The bullocks were gradually accustomed to "baisurai" by mixing a gradually increasing quantity in their other fodder until finally after a few days half the daily fodder was green baisurai. The experiments at Agra have conclusively shown that green baisurai can be used to replace half the total fodder required by working bullocks. The experiments at Aligarh were carried on for four months. They showed that a mixture of half green baisurai and half juar stalks was a much better fodder than a full ration of juar stalks alone. All the animals fed on the mixture gained in weight, whilst all those fed on juar stalks alone lost in weight. By feeding green baisurai to bullocks to the extent of half the total fodder ration, a saving per head of 40 maunds of juar stalks or bhusa can be effected in the nine months from September to June.

In the four districts of Aligarh, Muttra, Agra, and Etah there is a continuous tract of land, about one million acres in area, all more or less infested with baisurai. In this area there are about 150,000 working bullocks. These bullocks during nine months of the year are fed chiefly on bhusa and juar fodder. By feeding them baisurai as described above a saving of 140 maunds per head per year of other fodder would be effected. The total saving would be six million maunds of fodder. This would be available for sale and at present prices its value would be some fifty lakhs of rupees. The famine of 1913-14 was the severest fodder famine experienced in the United Provinces since 1878-79. Great efforts were made by Government and private agencies to supply fodder from outside sources to keep the cattle alive. The total amount of fodder imported into the famine districts was slightly under forty lakhs of maunds, that is, considerably less than the total amount we estimate could be released each year by feeding available supplies of baisurai in the Agra division.

Demonstrations of baisurai feeding have already been commenced and some converts have been registered. It is hoped to carry on more concentrated demonstration work soon. In the meantime baisurai is a regular part of the fodder ration of the bullocks at the Agra farm. Experiments on storage and other methods of using the weed are being tried and there is every hope of converting what has up to now been a troublesome weed into a useful agricultural article.

Miscellaneous demonstration work.

A Ransomes Thresher was worked for some time in the Muzaffarnagar district during the rabi harvest. It produced a good clean sample of wheat but the bhusa was not fine enough for the taste of the local cultivators. The demonstration showed clearly enough that if a machine capable of turning out a clean sample of grain and satisfactory bhusa can be made, the Muzaffarnagar wheat-grower would be quite prepared to pay a fair price to have his wheat threshed by machinery. Machinery of this nature is very necessary at present as at rabi harvest time pressure of work is very great in Muzaffarnagar and Meerut. In addition to cutting and threshing rabi crops sugarcane hoeing and watering are going on and in many cases ploughing of land for late cane is being done.

Threshing machinery of the right kind would ease the burden and would be welcomed by the agriculturist.

Steam ploughing.

The steam ploughing tackle is now working at Bazpur in the Naini Tal district.

Budaun tube well.

During the year a vigorous effort was made to put the demonstration tube well in Budaun on a paying basis. A year ago for demonstration purposes water was sold to the cultivators at the rate of Re. 0-8-0 per hour. In an hour about a kachha bigha is irrigated. The rate has gradually been raised and now stands at Rs. 1-8-0 per hour.

This rate should make the pumping plant self-supporting. During the year 120 acres of rabi were irrigated and 22½ acres sugarcane and kharif from which the total receipts were Rs. 986-6-3. The figures are interesting as showing what cultivators are prepared to pay for water. The past year was a dry one and water was at a premium. It now remains to be seen what the income will be in a year of normal rainfall.

Flax-growing.

Flax-growing expreiments were started in the Tarai and Bhabar estates and result so far obtained are encouraging.

Some flax was sown privately in the Muttra district where a company is putting down for machinery for flax-manufacture.

Pumping plant.

Several pumping plants and various kinds of machinery and implements owned privately in the circle were inspected and kept in running order.

Agricultural publications.

The following articles were prepared and contributed to the *United Provinces Journal* and other papers. Some of them were printed and issued as leaflets:—

1. An unexploited supply of cattle fodder.
2. A valuable fodder for cattle.
3. Protection of sugarcane crop from the attacks of white-ant.
4. Demonstration of cotton-sowing in Aligarh district.
5. Cultivation of American cotton (revised).
6. Storage of potato.
7. Different methods of sowing with special referenee to the sowing of maize.
8. Red rot in sugarcanes.
9. Machinery for threshing rabi crops.
10. Improved implements and machinery in agriculture.
11. An improved method of sowing early maize.
12. Reclamation of usar land.
13. Insects injurious to crops.
14. Method of planting trees.
15. Bee keeping.
16. Cultivation of betel leaf.

Correspondence.

No. of letters received = 4,818
No. of letters issued = 3,916

General.

Preliminary work has been commenced in Dehra Dun. It will be developed as funds and staff become available.

Experimental work.

The following are the most important lines of experiment work going on in the circle:—

(1) Variety tests of the following crops:—
Cotton, wheat, gram, sugarcane, juar, and arhar with the object of selecting more paying types.
(2) Cultivation experiments with cotton, wheat, maize, gram, sugarcane, indigo.
(3) Experiments on feeding cattle with baisurai or roshna (Pluchea Lanceolata).
(4) Study of dry farming methods with special reference to conservation of moisture for rabi-sowings.
(5) Fodder storage trials with special reference to famine conditions.
(6) Manure conservation experiments.
(7) Usar reclamation experiments.
(8) Trials of machinery and implements for interculture work, harrowing trench-making, crusting sugarcane, threshing rabi crops, lifting water, etc.
(9) A study of the red rot problem in the Saharanpur district and methods of coping with it.
(10) Experiments on storage of rabi grains to protect them from weevils.
(11) Trials of a new method of potato storage.

A. E. PARR,
Deputy Director of Agriculture, Western Ccircle.

APPENDIX II.

Report on the administration of the Central Circle of the department of Agriculture, United Provinces, for 1920-21 *by* MR. T. R. LOW, B.SC., *Deputy Director of Agriculture.*

Staff.—Mr. B. C. Burt remained in charge of the circle till the 31st of March, 1921, when he handed over to me and I have held charge for the remainder of the year.

Eight students passing out of the Agricultural College were appointed to the junior grade of the Subordinate Agricultural Service in this circle during the year and an addition of 16 fieldmen was made to the cadre.

Three members of the Subordinate Agricultural Service on Economic Botanist's Establishment were temporarily deputed to the Central Circle, on completion of Cotton Survey work.

Tours.—During January I was in camp in the Cawnpore and Etawah districts with the late Deputy Director of Agriculture

Farms.—A small demonstration farm of 25·93 acres was opened during the year at Jaitpur, district Hamirpur. A project for the opening of a potato-growing farm in district Farrukhabad is under consideration and it is hoped that the farm will shortly be started for the study of the special problems connected with potato-cultivation in this area.

District Work.

Wheat.—The introduction of Pusa 12, wheat in the Oudh and Doab portions of the circle was continued. The quantity of Pusa 12 wheat distributed from centres was as follows:—

		Maunds.
1.	Cawnpore	4,046
2.	Fatehpur	863
3.	Etawah	2,503
4.	Mainpuri	812
5.	Hardoi	3,286
6.	Sitapur	1,068
7.	Unao	933
8.	Banda	283
9.	Hamirpur	1,397
10.	Jalaun	540
	Total ..	15,731

In Bundelkhand the distribution of Pusa 4 wheat was continued on the Ken, Dhasan, and Betwa Canals in districts Banda, Jalaun, and Hamirpur. On the Kuthaund Branch of the Betwa Canal Pusa 12 wheat was distributed as in previous years for sowings on *parwa* soil and Pusa 4 on *Kabar* and mixed soils. The quantity distributed was as follows:—

District.	Pusa 4.	Soharia.	Bangasia.
	Maunds.	Maunds.	Maunds.
Banda	1,817	..	..
Hamirpur	1,405	..	..
Jalaun	378	272	10
Total ..	3 600	272	10

A small quantity of C. 13 wheat was also distributed in Banda district and 272 maunds of Soharia for unirrigated black soil in Jalaun.

In Etwah and Hardoi the whole of the seed was supplied by the District Board. The Sandila Central Co-operative Bank and the Mainpuri Agricultural Supply Society also supplied a small quantity of seed. The Court of Wards Estates, Sitapur, distributed 1,068 maunds and the Harchandpur Court of Wards, district Etawah, 942 maunds. The demand for seed greatly exceeded the supply and only 20,019 maunds could be distributed.

In Bundelkhand division the bulk of the seed is given on taqavi and the Commissioner of the division has approved a simplified procedure which will reduce considerably the labour of dealing with these applications. We are again indebted to the Canal staff for assistance in seed distribution. A new standard pattern seed godown capable of storing some 8,000 maunds of seed has recently been completed and opened at Pokhrayan, district Cawnpore.

The area under improved wheats in the Central Circle so far as it could be ascertained was as follows:—

Pusa 4.	Pusa 12.	Pusa 110.	C 13.	Soharia.	Total acres.
3723·19	11,478·21	30·75	124·85	249·00	14,883·50

Cotton.—American Cotton. The extension of C. A. 9 cotton, which has proved to be the best of the American selections, was continued and, as in previous years, special selected channels were guaranteed by the Canal department. A shortage of canal water at the time of sowing resulted in smaller areas of American cotton being sown, the actual area being 3,380·83 acres compared to 8,100 acres in the previous year.

The market for American cotton is now established and the prices offered are independent of *desi* cotton. Cultivators of American cotton received about Rs. 4 per maund more than *desi kapas* for their cotton. American cotton prices remained high during the season, while prices offered for *desi* cotton varied from Rs. 9-4-9 per maund to Rs. 7-3 3.

Desi cotton,—J. N. 1. Seed of this cotton was distributed in Hardoi, Unao, Banda, Hamirpur; and Jalaun. The demand for this variety was keen throughout the unirrigated portion of the circle but the supply being limited only 377 maunds could be distributed.

K. 22.—Some seed of this cotton was also distributed in Hardoi and Unao.

The amount of cotton varieties distributed in the year 1920-21 is as follows:—

American cotton.	J. N. 1 cotton.	K. 22 cotton.
Mds srs. chs.	Mds. srs. chs.	Mds. srs. chs.
3,107 0 4	377 11 2	46 32 15

Sugarcane.—As in previous years, the whole of the supply of cane sets from the various farms was readily taken up and the total issues aggregated 4,029 maunds.

Organized demonstrations of the proper method of cultivation for improved varieties are in progress on the Katesar estate (Sitapur) and in Banda and Hamirpur districts.

Rice.—Transplanting of rice is spreading steadily in parts of Banda. One hundred and seventeen acres of rice sown at the Atarra farm were issued as seedlings.

Other crops.—In addition to the more important crops mentioned above considerable quantities of seed of improved varieties of *juar* (327 maunds) Jaunpur maize (102 maunds), Unao early *arhar* (65 maunds), *bajra* (45 maunds), selected grams (230 maunds), groundnuts (96 maunds), peas (30 maunds), potatoes (33 maunds), rice (57 maunds), and barley (126 maunds) were distributed during the year.

General Demonstration work.—There are now 25 touring assistants in the circle carrying out village demonstrations. In some cases trained labourers from farms have been lent to these assistants to assist in these demonstrations. The principal demonstrations have been green-manuring for wheat, harrowing of wheat after the first irrigation to economize water, the use of ridgers for making irrigation *kiaris*, the use of iron ploughs and methods of using them, the use of castor and *mahua* cakes as manures, drill sowing of cotton, interculture of cotton, sowing of improved sugarcanes in trenches and the improved methods of *gur*-making and the use of improved iron sugarcane mills.

The following table gives a rough idea of the general demonstration work done in the circle:—

STATEMENT OF GENERAL DEMONSTRATION WORK DONE IN CENTRAL CIRCLE.

District.	Staff.	Number of visits.	Growing improved crops.					General demonstration.			Remarks. (Principal demonstrations.)
			Wheat.		Cotton.		Others.	Villages.	No.	Area.	
			No.	Area.	No.	Area.					
Cawnpore F ..	5 ..	1082	349	2007·17	263	2122·13	273 54	184	361	472·79	Green manures, lever harrows, hot weather cultivation, sowing of cotton in lines.
Etawah F ..	2 ..	187	103	2864·50	71	352·16	1158·55	21	247	150·0	Ditto.
Fatehpur ..	1* ..	501	151	1107·6	114	604·10	108·3	29	104	146·6	Green manures Harrowing wheat, deep ploughing, 98 ploughs,
Mainpuri F ..	1 ..	182	86	1357·0	30	125·70	262·95	36	135	85·0	Ploughs, cultivators, line sowing, lever harrowing.
Tahsil Tirwa (Farrukhabad).	1 ..	43	..	142·50	..	267·30	60·50	..	..	143·59	Lever harrow, ploughs.
Unao ..	1* ..	237	60	465·35	40	102·25	107·85	35	..	..	One hundred and ninty-five ploughs purchased. Green manure, lever harrow.
Hardoi F ..	2 ..	238	91	744·83	38	126·15	62·32	13	27	13·33	Also supervised three tube wells.
Sitapur ..	1* ..	235	14	588·0	10	51·50	34·50		..	..	Green manures. Jute experiments. Also supervised two tube wells.
Jalaun F ..	2 ..	223	42	1016 0	45	446·75	141·25	30	26	45·00	Principlaly seed-distribution.
Banda F ..	3* ..	95	35	1961·0	3	4·25	170·70	30	52	223·50	Lever harrow, green manure, iron ploughs, sugarcane mills, and pans.
Hamirpur F ..	2 ..	368	52	2808·95	..	..	503·70	56	..	628·29	Ditto.
Jhansi ..	No staff	..	..	..	..	..	..	..	..	..	Seed and implements issued and enquiries answered but no staff in the district.
Kheri ..											
Allahabad ..											

* Trained labourers in addition.
F Experimental or district farms.

Seed and Demonstration Farms.

The following is a statement of the total receipts and expenditure of the farms in the circle :—

	Receipts. Rs. a. p.	Expenditure. Rs. a. p.
Cawnpore farm	7,096 14 4	11,913 4 11
Jalaun farm	3,716 13 11	7,950 2 10
Attara farm	11,668 8 7	16,077 2 6
Seed farm	22,717 1 6	30,231 10 0
Etawah farm	4,130 5 2	5,038 12 3
Mainpuri farm	2,965 6 5	5,781 14 2
Hardoi farm and seed store	21,672 8 1	19,330 8 9

Court of Wards estates.—Demonstration and seed farms are maintained by three Court of Wards estates, viz., Harchandpur (Etawah), Rampura (Jalaun) and Katesar estate at Nabinagar (Sitapur). The Sitapur Court of Wards estate has opened two more farms during the year at Mallahpur (Porter farm) and Baragaon. The main object is to maintain a profitable home farm for the estate which can also be used as a source of seed-supply and for demonstrating improved methods to the tenants of the estate. The Court of Wards estate farm at Naraini in Banda district, referred to in previous reports, was also maintained.

The seed store maintained by the Sitapur Court of Wards estates at Nabinagar stored and distributed 1,068 maunds of Pusa 12 wheat to tenants and the Harchandpur farm 942 maunds. The Rampura estate also grows considerable quantities of seed for distribution to tenants.

Private farms.—The number of private farms has increased from 60 to 124 during the present year.

Babu Narayan Prasad of Macha, district Cawnpore, has continued to run his 40-acre compact farm, which has been of great assistance to us in local demonstration work. The nett profit on this farm was Rs. 1,108 on a working expenditure of Rs. 2,735. The working expenses of Umarya farm, referred to in last year's report, were Rs. 2,486 and receipts Rs. 2,815. The Sachendi farm has been extended to 250 acres during the year and arrangements are in progress for adding another 250 acres to this farm.

In Etawah district Rao Narsingh Rao has opened two more farms of 40 and 150 acres each in village Dhakpura, which are being laid out.

In Mainpuri district there are now 23 areas of *sir* land varying from 10 to 50 acres worked by their owners under our advice.

In Fatehpur district the number of home farms has increased from 4 to 12 varying from 75 to 10 acres in area.

In Allahabad the Raja of Baraon has maintained his home farm at Baraon. The two private farms at Kuthaund and Naraini in Banda district were also maintained.

There is a growing tendency amongst the zemindars of Cawnpore district to cultivate their *sir* or *khudkasht* as home farms and the number of such farms in this district has risen from 9 to 39 varying from 10 to 250 acres in area.

In Sitapur district there are now ten private farms varying from 200 to 15 acres in size.

Farms and demonstration areas on sir land.

District.	Situation.	Owner.	Area acres.	Remarks.
Cawnpore ..	Macha	Babu Narayan Prasad ..	40	Compact farm, well equipped, principal crops Pusa wheat, American cotton.
	Umarya	M. Shah Beg ..	35	Ditto.
	Naunapur	Babu Ausari Lal ..	10	General demonstration.
	Dekchi	Babu Mata Prasad ..	10	Ditto.
	Sachendi	Lala Laxmi Narain Agarwala.	250	Intended for seed-supply to tenants and general demonstration. All crops recommended.
	Kursauli	Thakur Baldeo Singh ..	15	Pusa wheat, American cotton.
	Chak Ratanpur ..	Babu Madho Prasad ..	10	Newly started.
	Nankari	Pandit Misri Lal ..	14	Ditto.
	Pem	Thakur Sunder Singh ..	20	Ditto.
	Pargahi	Thakur Putti Singh ..	30	All crops recommended.
	Bagdaudhi	Pandit Bindeshwar Misra	85	Ditto.
	Ramnagar	Babu Gaya Prasad ..	18·5	Ditto.

Farms and demonstration areas on sir land—(continued).

District.	Situation.	Owner.	Area acres	Remarks.
	Shadipur	Pandit Muthra Prasad	7·5	Newly started.
	Shadpur	Pandit Sita Ram Pande	10	Ditto.
	Maharajpur ..	Pandit Durga Prasad Pande.	6	Ditto.
	Sarayan	Babu Kashi Prasad ..	11	Ditto.
	Do.	Pandit Laxmi Narain Shukla.	24	Ditto.
	Umedpur	Mania	12	Ditto.
	Do.	Babu Sarju Prasad ..	22	Ditto.
	Hanspur	Babu Banke Lal ..	19	Ditto.
	Ratanpur	Babu Kalicharan ..	11	Ditto.
	Bilahripur	M. Muhammad Husain	10·5	Pusa wheat, American cotton.
	Garhewa	Babu Shiam Lal ..	10	Ditto.
	Patara	Thakur Mukund Singh	40	Ditto.
	Do.	Thakur Bahajan Singh	20	Ditto.
Cawnpore ..	Do.	Seth Sukhnandan ..	20	Ditto.
	Kathorua	Thakur Govind Singh..	50	All crops recommended.
	Kanhra	Ch. Patyan Singh ..	50	Ditto.
	Bidhnu	Pandit Raja Ram Misra	40	Ditto.
	Ramaipur	Thakur Bahiron Singh	50	Ditto.
	Magosa	Pandit Laxmi Narain Tewari.	20	Ditto.
	Narwal	Pandit Matadin Shukla	25	Ditto.
	Kudni	Ch. Debi Singh ..	40	Ditto.
	Do.	Ch. Sardar Singh ..	40	Ditto.
	Do.	Ch. Kalyan Singh ..	30	Ditto.
	Hinour	Pandit Binda Prasad Dubey.	25	Ditto.
	Rar	Pandit Shyam Lal Bajpai	30	Ditto.
	Fatehpur	Lala Chandi Prasad ..	40	Ditto.
	Pasewa	Kallu, Tamoli ..	35	Ditto.
	Jahanabad	Lala Adya Saran Singh	75	Compact block, Pusa 12 wheat, American cotton and other improved crops,
	Makrali	Pandit Ganga Prasad ..	14	General demonstration.
	Auseri Khera ..	Pandit Cheda Lal ..	16	Ditto.
	Deomai	Pandit Shambhu Parsad	20	Ditto.
	Kunh	Pandit Khare Parsad ..	30	Ditto.
	Makrandpur ..	Pandit Bishambhar Nath	10	Ditto.
Fatehpur ..	Fatehpur	Babu Alakh Sarup ..	20	Ditto.
	Do.	Babu Ishwar Sahai ..	20	Ditto.
	Kakhraru	M. Safirullah Khan ..	10	Ditto.
	Barahatu	M. Wasi Ali ..	40	Ditto.
	Deopura	Babu Matadin ..	12	Ditto.
	Asni	Pandit Newal Behari ..	10	Recently started.
Etawah ..	Jaksara	Babu Ram Sarup ..	50	Zamindar's *sir*, 21 acres of Pusa, 12 wheat, 10 acres of American cotton and demonstration of other crops and of ploughs.

Farms and demonstration areas on sir land—(continued).

District.	Situation.	Owner.	Area acres.	Remarks.
	Partabnair ..	Lieutenant Raja Hukum Tej Partab Singh, M.L.C.,	40	*Sir* land, 20 acres Pusa 12 wheat, 10 acres, American cotton and demonstrations as above.
	Heonra	Thakur Kalka Prasad	30	*Sir* land, Pusa 12 wheat, American cotton and iron ploughs.
	Kuain	Chaudhri Angnu Singh	50	*Sir* land, 20 acres Pusa 12 wheat, 15 acres American cotton, demonstration and ploughs.
	Damodarpur ..	Lala Jai Narain ..	50	Ditto.
	Balrai	Thakur Maharaj Singh	30	*Sir* land, Pusa wheat, American cotton and other improved crops and ploughs.
	Purwa Khuman ..	Ch. Hanu Parshad ..	25	Ditto.
	Bailipur	Pandit Brahama Din Shukla.	30	Ditto.
	Asa	Thakur Jatwar Singh ..	50	Ditto.
	Banthara ..	Thakur Balwant Singh	50	Ditto.
	Kuderkot	Pandit Sheo Charan Lal Tewari.	30	Ditto.
	Achalda	Thakur Puttu Singh ..	50	Ditto.
Etawah ..	Baghaipur ..	Rao Narsingh Rao ..	40	Compact, well equipped with implements. All crops recommended for the district.
	Shahpur	Thakur Beni Madho Rao.	15	*Sir* land, wheat, cotton, ploughs.
	Faridpur	Pandit Ram Partab Singh	30	Ditto.
	Bhoradana ..	Chaudhri Bishambhar Nath.	50	Ditto.
	Aurang	Rao Narsingh Rao ..	60	Compact, well equipped. All crops recommended for the district.
	Mahdipur	Chaudhri Hanwant Singh.	40	Compact, well equipped. All crops recommended for the district.
	Nagarya Lalpur ..	Chaudhri Beni Madho Rao.	30	Zamindar's *sir*, Pusa wheat, American cotton. Plough demonstrations.
	Dalipnagar ..	Pandit Anand Madho ..	50	Pusa wheat, American cotton, sugarcane and plough demonstrations
	Kara	Thakur Lachman Singh	30	Ditto.
	Dhakpura ..	Rao Narsingh Rao ..	40	Being laid out.
	Do. ..	Ditto ..	150	Ditto.
	Berari	Babu Shiam Behari Lal Bhatle.	10	*Sir* land, Pusa wheat, American cotton.
	Sikanderpura ..	M. Hakim Uddin ..	20	*Sir* land. All crops recommended.
	Kosma	M. Haidar Khan ..	35	Ditto.
	Fazilpur	Thakur Lochan Singh	20	Ditto.
	Kalhore	Thakur Gulab Singh ..	20	Compact block. All crops recommended.
	Sagauni	Thakur Dwarka Singh	40	Ditto.
	Lakhaura	Chaudhri Durga Parshad	25	Occupancy land. All crops recommended.
	Jeonti	Pandit Sita Ram ..	15	*Sir* land. All crops recommended.
Mainpuri ..	Alipur Patti ..	Pandit Chiraunji Lal ..	15	Ditto.
	Parhana Salimpur ..	Thakur Digbijai Singh ..	50	Compact block, *sir* land. All crops recommended.
	Garehia Chankura ..	Chaudhri Jung Singh ..	25	*Sir* land. All crops recomended.
	Sogaon	Thakur Akbar Singh ..	15	Ditto.
	Shikohabad ..	Lala Bhola Nath ..	25	*Sir* land, compact block. All crops recommended.
	Nain	Banbari Ishwar Das ..	10	*Sir* land. All crops recommended.
	Do.	Thakur Manohar Singh	20	Ditto.
	Ukrend	Thakur Bishun Singh ..	25	Ditto.
	Lakhnai	Thakur Gulab Singh ..	25	*Sir* land, compact block. All crops recommended.

Farms and demonstration areas on sir land—(concluded.)

District.	Situation.	Owner.	Area acres.	Remarks.
Mainpuri ..	Havelia	Pandit Sughar Singh ..	25	*Sir* land. All crops recommended.
	Bimtapur	Pandit Bisheshwar Singh.	20	Ditto.
	Jasrana	Thakur Hukum Singh..	10	Ditto.
	Baltigarh	Babu Behari Lal ..	20	Ditto.
	Suraya	Thakur Sarnam Singh..	10	Ditto.
	Nayabans	Babu Ram Sarup Gupta	15	Ditto.
Sitapur ..	Nabinagar	Court of Wards estate, Sitapur.	100	Pusa 12, sugarcane and other improved crops, well equipped.
	Mahmudabad ..	Raja Saheb of Mahmudabad.	15	All crops recommended.
	Mallahpur	Court of Wards, Sitapur.	200	Pusa wheat, sugarcane, well equipped.
	Baragaon	Ditto ..	40	Recently started.
	Dhamni Sarai ..	S. Tajummul Husain ..	40	*Sir* land, wheat, sugarcane, and other improved crops.
	Biswan	Chaudhri Ganga Bux Singh.	40	Ditto.
	Kotra	Raja Saheb of Kotra ..	40	Recently started.
	Sahmipur	Babu Chail Behari Lal	15	Pusa 12 wheat, *sir* land.
	Kateli	Kateli estate ..	50	*Sir* land, wheat, sugarcane etc.
	Chauria	Thakur Rampal Singh..	70	Recently started, *sir* land, wheat, sugarcane etc.
Hardoi ..	Rara	Thakur Bhabuthi Singh	80	Pusa 12, cotton, juar and other improved crops.
	Gopar	Thakur Paras Ram Singh.	40	Ditto.
	Kantha Thok ..	Thakur Roshan Singh..	56	Ditto.
	Turtipur	Pandit Manik Chand ..	40	Ditto.
Allahabad ..	Baraon	Raja Saheb of Baraon	35	Compact farm General demonstration.
Banda ..	Naraini	Pathak Harbans Prasad	50	Compact farm. Owner ex-student of Agricultural College.
	Khuhand	Thakur Har Parsad Singh.	250	Compact farm, specializes on seed production, particularly Pusa wheat.
Jalaun ..	Rampura	Court of Wards ..	30	Compact farm. All crops recommended.
	Do.	Thakur Budha Singh ..	34	Ditto.
	Jagammanpur ..	Raja Saheb of Jagammanpur.	100	Ditto.
	Madhogarh.. ..	Babu Murli Dhar ..	30	Ditto.
	Akbarpur	Thakur Hanwant Singh	30	Ditto.
	Do.	Thakur Harchand Singh	30	Ditto.
	Biria Madhogarh ..	Thakur Ujagar Singh ..	16	Ditto.
	Ramnagar	Thakur Salik Singh ..	15	Ditto.
	Karsan	Babu Indarji Mal ..	25	Ditto.
Farrukhabad ..	Kanauj	Rai Bahadur Babu Sarup Narain.	20	Pusa wheat and other improved crops.

Co-operative Societies.—Efforts were continued during the year to utilize the co-operative organization to a larger extent in connection with the spread of agaricultual information, distribution of vernacular agricultural literature and the supply of seeds and implements. The Sandila and Jasrana Central Co-operative Banks have continued to run seed stores successfully. The Hardoi Agricultural Supply Society and the Sandila Central Co-operative Bank carry a stock of ploughs, sugarcane mills and oil cakes for supply to members. The Unao Town Bank also stock a number of ploughs for sale. The Mainpuri Agricultural Supply Society stored and distributed 300 maunds of Pusa 12 wheat during the year.

Manures.—Dépôts for oil cakes are maintained at the various district farms and at the Nabinagar seed store in the Katesar estate. The Hardoi Co-operative Agricultural Supply

Society and the Sandila Central Co-operative Bank also stock oil cakes for sale. The quantity of oil cakes issued from Cawnpore Dépôt during the year was 3,220 maunds.

Strainer Tube Wells.—The demonstration tube well at Tateora, district Hardoi, was worked departmentally throughout the year. The area irrigated was 213 acres, and profits after paying all expenses Rs. 287.

The tube well at the Hardoi farm also supplied water to cultivators for 56·9 acres, profits from this irrrigation being Rs. 442.

The tube well at Gopar, owned by a zamindar, irrigated 100 acres of wheat and also supplied water to cultivators for 200 acres of *rabi* and 40 acres of *kharif* crops.

Tube wells are being constructed at Manpur, Rara, Kanta Thok, Gadanpur and Baghauli, all in district Hardoi.

The Katesar estate tube wells in district Sitapur also worked throughout the year for irrigation of wheat and sugarcane crops.

Agricultural Shows.—District exhibitions with agricultural sections were held at Etawah, Hardoi, and Mainpuri. Agricultural shows were also held at Makanpur and Patara, in district Cawnpore, Sheorajpur and Jahanabad (Fatehpur), Kotra and Shahpur (Sitapur), and Nimgaon (Kheri). Exhibits of crops and implements and assistants to demonstrate them were sent to all the above shows, vernacular lectures on agricultural matters were given and departmental pamphlets in English, Hindi, and Urdu distributed.

Implements.—The introduction of improved implements has been seriously hampered by steadily rising prices. In spite of this the use of improved iron ploughs is becoming more general and the demand for other improved cultivating implements is increasing. Six hundred and eighty-eight implements were issued from Cawnpore, 105 from Atarra, 195 from Unao, 55 from Sitapur, and 42 from Sandila (Hardoi). In all 1,141 implements were sold during the year.

The main demand has been for ploughs, water lifts and sugarcane mills. The number of spare parts sold for ploughs was 1,969. There is a demand for improved sugarcane mills in Banda and Hamirpur districts, of which 24 were sold in the latter district.

Experimental work.

Wheat.—The series of hybrid wheats from the Imperial Economic Botanist, Pusa, have been given another extensive exprimental trial at the Kalianpur farm owing to lack of space at Cawnpore, and certain varieties have given results which will warrant their adoption on a field scale next *rabi* season but the Pusa 4 and 12 varieties have in the past given such good results in general distribution and have now become so firmly established that it is not intended to supplement them for gereral distribution until a definitely superior variety has been obtained by further tests.

Flax.—Experimental sowings were again carried out on the Cawnpore and Kalianpur farms and 39·14 maunds of seed were distributed to cultivators in the neighbourhood of Mandhana, district Cawnpore, giving 19·85 acres of flax cultivation. The produce, some 300 maunds of straw and 60 maunds of seed, was bought under special arrangement by the department and this will eventually be disposed of to the Dooriah Flax Factory. Owing to the unexpected slump in the price of flax there is not the profit in this crop at present that might have been expected. During the year a Calcutta jute firm sent their representative to investigate the possibilities of installing a flax retting and scutching factory in the circle which would eventually be run on the same system as an indigo factory but the present low prices will probably hold this scheme up for the time being.

Jute.—A series of experimental plots were arranged in different parts of the Sitapur Ganjar tract to test the possibility of growing jute. The area grown was approximately 12 acres in a series of about 60 experimental plots scattered through the Ganjar area in such a way as to test the suitability of different parts of this tract. The crops at Shahpur, Amba and Hazaripurwa were good and one at Amba exceptional. Jute at Kuseppa grown entirely without irrigation was excellent and the same was reported of some jute near Samodidih. This jute was all grown on Kodon or rice land and it is there that it may be expected to be an economic proposition.

In villages Kuseppa and Samodidih yields ranging from 29 to 20 maunds per acre were obtained and the jute was valued at Rs. 15 per maund. In Rampur Muttra estate yields varying from 22½ to 15½ maunds per acre were obtained and in two other villages, where the cultivation was not so good, 11 maunds and 12 maunds per acre.

Tractors.—No new tractors have been purchased during the year.

Reclamation of ravine land.—The work on the Bohadpura and Chamari ravine blocks has been continued. At both blocks about two thirds of the area is fenced and planting of babul on the system recommended by the Forest Department has been extended. Bund construction has been carried on at both blocks and at Bohadpura a large bund with a catchment area of some 250 acres has recently been completed and handed over to this department by the Irrigation Department. At present the only return from these areas is a certain amount of grass in September and October.

Correspondence.—The number of letters received during the year was 7,107, issued 6,311, letters.

General.—Agricultural enquiries apart from applications for seed etc., dealt with by post aggregated 1,061 apart from those dealt with direct by touring assistants.

Receipts.—The circle receipts for the year ending 30th June, 1921, amounted to Rs. 52,570-5-4, of which seed and demonstration farms contributed Rs. 29,812-13-1.

Publications.—The existing cultivators' pamphlets and leaflets were revised and brought up to date. The demand for vernacular pamphlets on agricultural matters ran into many thousands.

T. R. LOW,

Deputy Director of Agriculture, Central Circle, Cawnpore.

APPENDIX III.

Report on the administration of the Eastern circle of the Agricultural department, United Provinces, for 1920-21, *by* RAI BAHADUR L. C. SHARMA, M.R.A.C., P.A.S.I., *Bar.-at-Law, Deputy Director of Agriculture.*

1. Eastern circle consists of 12 districts, viz., Fyzabad, Bara Banki, Lucknow, Rae Rareli, Sultanpur, Partabgarh, Mirzapur, Benares, Ghazipur, Ballia, Azamgarh and Jaunpur. The headquarter is at Partabgarh.

2. *Staff.*—Besides the Deputy Director of Agriculture who holds charge of the circle, the following staff represents the strength of the circle.

Divisional Superintendent of Agriculture who supervises the work of five districts mentioned last in the above paragraph, six Agricultural Superintendents, 21 Agricultural Overseers, 20 fieldmen. Every district of the circle is now provided with an Agricultural official and a Demonstrator. Mr. Deokinandan acted for me for 1½ months when I was on leave. Since May last he has gone on four months' leave Chaudhri Hari Ram Singh has been put on special duty in the Rohilkhand circle for a few months. Most of the members are content merely with routine performance and show little tendency to making independent observations. This is due partly to the fact that the Deputy Director hardly gets any time to devote to the training of the staff. Our success must, however, chiefly depend on the quality of the work that we can get out of them. Need for a propagandist is keenly felt.

3. The work of the circle, done during year under report may be classified as below:—

I. experimental investigations.
II. district farms and field demonstrations.
III. general supervision of most of the private farms.
IV. seed and cake dépôts.
V. miscellaneous work.

I. *Experimental investigations*—These were chiefly conducted at the Partabgarh and Benares Agricultural stations, and the details of this work together with the results obtained are given in the combined reports of the said stations for the year 1920-21. It will not, however, be out-of place to mention here in brief some of the more useful results so far achieved.

(*a*) *Varietal experiments.*—1. With wheat, barley, peas, maize, *bajra* and groundnuts conducted during the past few years have clearly proved that P. 12 wheat, Ballia and Rewari varieties of barley, Budhia and long marrow fat peas, Jaunpur maize, thorny and Jeypur varieties of *bajra* and Japanese groundnut, are best suited for this circle and we are trying to introduce them. P. 4 and C. 13 varieties of wheat are still under trial and have so far given quite satisfactary results.

2. With sugarcanes. Among thick varieties, Mauritius no. 16, Lalgainda of Gorakhpur have again done the best. Among the Shahjahanpur medium varieties, S. 39 stood first while among those of the thin canes Reora of Benares and Kuswar of Paratagarh maintained their first position. Sugarcane is another crop to which this circle is giving special attention, both on the experimental farms and the demonstration centres. Seed of the selected varieties is distributed from the farms and their cultivation in various places is supervised by the staff. Thick canes require a much higher standard of cultivation, we therefore recommend the medium varieties S. 48 and S. 39 in preference.

3. With cotton. Aligarh yellow flower and Jn. I gave net profits of Rs. 94 and 95 per acre respectively. Demand for cotton seed is growing and there is every reason to believe that superior and more paying varieties of cotton will be successfully grown in this circle.

(*b*) *Manurial experiments with paddy.*—Cattle dung manure at the rate of 200 maunds per acre gave a net profit of Rs. 99-8 per acre against Rs. 30 the average profit of a cultivator from the paddy crop.

(*c*) An experiment of flat sowing versus trenches was conducted with S. 48. The result shows that sowing in trenches gives higher outturns. This method gave us 3,760 lbs. of *gur* per acre in spite of the unfavourable season.

(*d*) Planting with top sets gives a higher yield than from ordinary sets. This system does not merely give higher yield but saves a lot of best portion of canes for making superior quality of *gur* which becomes inferior when tops are also crushed for the juice.

(*e*) Recent experiments have tended to prove that the quality of raw sugar depends on the stage of ripeness at which the canes are cut for crushing, and the method of manufacturing it rather than the variety of cane and the kind of manure applied to the crop.

(*f*) *Seed rate experiment.*—The results of the past few years show that 80 to 90 lbs. per acre sowing rate for wheat gives higher outturns than that of 110 to 140 lbs. commonly used. Thus apart from the higher outturns there is a clear saving of Rs. 3 per acre in seed alone.

(*g*) Considerable attention is paid to reducing the cost of cultivation of various crops by using more efficient implements which also thoroughly mix up the manure and thus help in increasing the outturns also.

(*h*) *Dhaincha* :—It has a very strong root system and has proved better than any other crop for opening out stiff sub-soils and to serve for green manuring. It is best suited for green manuring the *usar* fields.

(*i*) *Reclamation of ravine land.*—The ravine land at Chilbila referred in the previous year's report is still under trial and a good deal has been done towards the improvement of this ravine. The land has now been practically converted into culturable area and is quite fit for growing most of the *rabi* and *kharif* crops. During the year under report a few *kharif* and *rabi* crops were taken on it with advantage. A good many tenants in the neighbourhood have followed our example and are well impressed with the results they have so far achieved. The fruit trees planted by us on this land a few years ago are all doing well and prospering.

(*j*) *Reclamation of usar land.*—An account showing the various methods under trial for reclaiming *reh* or *usar* lands on the Partabgarh, Muswapur and Sarwanpur farms was given in the annual report for the year 1919-20.

These methods have so far given satisfaction and are well suited where reclamation is desired, gradually and with the minimum investment.

A visit at the Partabgarh or the Muswapur and Sarwanpur farms in the Sultanpur district will show the value of this more clearly than what may be explained in the report.

II.—District Farms and field demonstrations.

In this circle, there are only two large sized farms, one in Fyzabad and the other at Nogawan in Sultanpur district, which serve the purpose of giving demonstrations on a large scale as well as growing improved varieties of seed. The former is a Government farm and the latter is taken on lease from the Raja of Amethi. Want of similar farms in other districts is keenly felt. In fact, had it not been for the private farms started by Taluqdars and other zamindars it would have been impossible to meet the demand for improved seeds and to satisfactorily carry on the demonstration work in the absence of the Government district farms. Small district farms on leased lands on which some selected demonstrations were given during the year under report also served the purpose to some extent. The demonstration work of the circle is chiefly carried out by way of field demonstrations through interested zamindars and cultivators who fully discuss the objects demonstrated and immensely appreciate this kind of work, in fact look upon it as if a great assistance given to them by the department.

District programmes of demonstration work are suggested by the Deputy Director of Agriculture and discussed by the members before the lines of work are finally decided. Every programme is limited to certain areas to suit local conditions of soil and cropping so that much accuracy and progress may be possible than in the case where lands and crops vary and have little in common from an agricultural point of view.

The following list shows the demonstrations that are given in this circle :—

1. The use of improved ploughs, harrows and cultivators.
2. Sowing of thick and medium canes in trenches.
3. Sowing of maize in rows and earthing up.
4. Sowing with drill.
5. Demonstrations with various *rabi* and *kharif* seeds that yield higher outturns of superior quality.
6. Trial of certain thick and medium sugarcanes on large areas.
7. Application of castor, *neem* and *mahua* cakes where farmyard manure is not available.
8. Methods of planting paddy seedlings.
9. Demonstrations of seed rates, green manuring, rotation of crops and ensilage.
10. Demonstrations with tractor, thresher, harvester, and pumping plants.
11. Reclamation of *usar* and ravine lands.
12. Eradication of deep rooted grasses.

I inspected a good many demonstration centres just before the crops were harvested and in almost every case where the operations were properly carried out, the crops sown after improved methods were better and in many cases considerably so, than similar crops sown by local methods, while the saving in labour is very great. This was the opinion of the local Zamindars and the cultivators also. A large demand for demonstrations has sprung up but with the limited staff, the machinery, implements, stock of seeds and manures at our disposal we can only do our best to meet it as far as possible.

III.—General Supervision of most of the private Farms.

There are now 65 private farms as compared with 62 in the previous year. Among those started during the year under report the principal ones are Kalakankar (Court of Wards), Semri, Prithiganj, Anti Nogwan.

The private farms have created a real co-operation between the taluqdars and the department and may be looked upon as best agencies for multiplication of superior seeds, spreading improved varieties in place of the local inferior ones commonly grown by the cultivators, and rousing interest for agriculture among other taluqdars and well-to-do zamindars.

Some owners of the private farms have supplied me detailed reports of their respective farms which show a marked success and large profits made by them during this year.

Reports of other private farms have not yet been received but since the submission of this report cannot be delayed any longer, a brief mention is made only of those farms whose reports have been received.

List of the private farms who supplied the annual reports.

Serial number.	Name of Farm.	District.	Area in acres.	Expenditure.	Receipts.	Net profit.	Remarks.
				Rs. a. p.	Rs. a. p.	Rs. a. p.	
1	Kurri Sidauli	Rae Bareli ..	100	5,907 10 9	6,873 10 6	965 15 9	It belongs to Hon'ble Sir Raja Rampal Singh, K.C.I.E. The principal crops grown were P. 12 wheat, Kabuli gram, paddy, potato, etc. The pumping plant installed on one of the wells of the Farm has considerably increased the source of irrigation. The success of the Farm is chiefly due to the real interest of the owner, in the Agricultural improvements. The Farm gave a net profit of 16·3 per cent.
2	Chandapur	Ditto ..	37·5	1,645 8 3	2,535 0 0	889 7 9	It belongs to the Hon'ble Lieutenant Raja Chandra Chur Singh, and is managed by a trained man. The farm grows selected varieties of wheat, paddy, sugarcane, etc. The extent of keenness of the Raja Saheb towards agricultural improvements is clear from the fact that during the year under report he has invested Rs. 7,200 in constructing a shed for the pumping plant and irrigation channels. The farm gave a net profit of 54 per cent.
3	Rahwan	Ditto ..	196·5	4,899 1 0	6,820 6 0	1,921 5 0	It belongs to Thakur Jagannath Bakhsh Singh, M.L.C., Taluqdar of Rahwan Estate. The irrigation is done by means of a pumping plant lent by the Department P. 12 wheat is chiefly grown on this Farm. Thakur Saheb has got another large farm also chiefly for growing best varieties of sugarcanes. The success of these farms is chiefly due to the direct and competent supervision of the Thakur Saheb. The farm gave a net profit of 39·2 per cent.
4	Akbarpur	Ditto ..	46	2,312 8 0	2,853 12 3	541 4 3	This farm belongs to Sardar Nihal Singh, Bar.-at-Law, Taluqdar of Rae Bareli. It grows selected varieties of wheat, gram, peas, etc. He had four good sized farms already and a fifth one has been opened during the year under report. His interest for agriculture is growing fast every year. The Farm gave a net profit of 23·4 per cent.
5	Anti Nogawan	Ditto ..	37	584 1 9	765 13 3	181 11 6	This is a new farm started by Sirdar Nihal Singh, and in spite of the fact that this was its very first year it gave a net profit of 31 per cent. Wheat, barley, *arhar*, etc., were the principal crops of the farm.
6 & 7	Ondwa and Paraira.. ..	Ditto ..	229	8,448 7 6	9,469 11 3	1,026 3 9	These farms gave high profits last year and this year seeing the excellent crops that were growing, still higher profits were expected but the agrarian troubles hindered the progress of the work. Nevertheless the Farms made a net profit of 10·8 per cent.
8	Semri	Ditto ..	40	2,247 5 0	2,564 8 6	317 3 6	It belongs to Thakur Raghuraj Singh, taluqdar of Semri. It has been started during the year under report. Improved varieties of *juar*, *dhan*, *arhar*, wheat, etc., were grown on the Farm. It gave a net profit of 14·1 per cent.
9	Akbar farm	Ditto ..	73·75	1,730 0 0	1,770 0 0	40 0 0	It belongs to Chaudhri Muhammad Akbar of Inhauna. The farm has made a net profit of 2·3 per cent.
10	Kachaunda	Ditto ..	81·2	2,289 0 6	2,337 12 0	48 11 6	It belongs to Sirdar Bir Pal Singh, M.L.C., taluqdar of Rae Bareli district. P. 12 wheat, Kabuli and desi gram and dhan were the chief crops of the farm. The farm has made a net profit of 2·1 per cent. and is reported to have suffered on account of agrarian troubles in the district.

List of the private farms who supplied the annual reports—(concluded).

Serial number.	Name of farm.	District.	Area in acres.	Expenditure.	Receipts.	Net profit.	Remarks.
				Rs. a. p.	Rs. a. p.	Rs. a. p.	
11	Basaha	Lucknow ..	16·5	1,912 2 9	1,490 9 3	478 0 6	This belongs to Saiyid Zahur Ahmad, Advocate, Lucknow, and is situated on Kursi Road 8 miles from the town. A Chaudhri well that was installed on this farm has proved a great success. P. 12 wheat was chiefly grown. The farm gave a net profit of 47 per cent.
12	Kanosi	Ditto ..	18·75	1,038 0 0	1,743 2 0	705 2 0	It belongs to Sheikh Farzand Ali, Vakil High Court. P. 12 wheat was the principal crop grown at the farm. The Farm gave a net profit of 68 per cent.
13	Majasa	Ditto ..	7·0	300 0 0	349 1 3	49 1 3	It belongs to M Muhammad Ali Khan, taluqdar of Malihabad. P. 12 wheat alone was grown on the farm. The farm gave a net profit of 16 3 per cent
14	Qabulpur	Ditto ..	18·75	800 0 0	2,500 0 0	1,700 0 0	This belongs to Mr. Muhammad Nasim, Advocate, Lucknow, and is about 16 miles from Lucknow. The wheat crop alone gave an income of Rs. 2,500 The area of this farm has been extended to 125 acres a large portion of which will be put under P. 12 wheat next season. Mr. Nasim writes to say ' But for a Chaudhri well and the pumping plant it was physically impossible for me to have an area of 20 acres under wheat cultivation in a dry season like this. The success, which has been achieved at my Farm this year, has demonstrated to the people of the neighbourhood that the use of machinery for irrigation purposes is an absolute necessity for successful farming and I am quite sure some well-to-do gentlemen of my village are going to take to it, the next year." The Farm gave a profit of 212·5 per cent.
15	Sheikhupur Kasaila.. ..	Ditto ..	120	2,499 11 3	4,667 0 0	2,167 4 9	It belongs to the cultivators of the village who cultivate and grow crops etc. under direction of the Deputy Director. Formerly they used to grow inferior varieties of bajra, paddy, etc. But now only more paying and improved varieties are grown. The cultivators fully appreciate the assistance given to them and are quite happy.
16	Fort Partabgarh	Partabgarh ..	60	2,876 12 0	7,711 4 0	4,834 8 0	This belongs to the late Raja Bahadur Partap Bhadur Singh, C.I.E. of Fort Partabgarh and is situated close to this palace on Katra road. Best varieties of sugarcane, wheat, gram and peas are chiefly grown. The farm gave a net profit of 180 per cent.
17	Jang Bahadur farm ..	Sultanpur ..	50	458 0 0	671 4 0	213 4 0	It belongs to Kunwar Jang Bahadur Singh of Amethi Raj. There are two other farms belonging to the Raja Saheb but as he was much shocked with the untimely death of his son he could not personally look to his estate affairs and very little work was therefore done in his farms. This farm however still gave a net profit of 46 per cent.
18	Milkipur..	Fyzabad ..	100	564 0 0	2,997 15 6	2,433 15 6	It belongs to Babu Bipin Chandra Chatterji, Vakil, Fyzabad, P. 12 wheat and selected varieties of early and late paddy were the chief crops grown on the farm. It gave a net profit of 431 per cent.
19	Dharupur	Do. ..	100	429 13 0	2,131 5 6	1,701 8 6	It belongs to Mr. K. P. Sinha, M. L. C., Bar.-at-Law. It is expected that the area will be largely extended and provide all kinds of facilities to the zamindars and cultivators of the neighbourhood. The farm gave a net profit of 396·5 per cent

Apart from the private farms there are 16 District Board School farms in Lucknow district which though small in areas but serving a very useful purpose The main object of these is to impart instructive lessons on practical agriculture to the students. The seeds were issued to the Secretary, District Board, from the Government Seed Depôts for these farms and an agricultural overseer frequently visits them to render the required assistance.

IV.—Seed and Cake Dépôts.

There are 32 seed dépôts (e.g. 22 Government, 6 district Boards, and 4 Court of Wards) in this circle. Besides, every private farm serves the object of an organized seed dépôt.

Five of the Government Seed Dépôts are financed by the permanent advance of Rs. 15,000 and the rest by the temporary advances of Rs. 50,000 held by the Deputy Director of Agriculture. All the seed dépôts including those of the District Boards and that of the Court of Wards are managed by the Deputy Director. The object of these dépôts is twofold. (1) Replacement of the local inferior varieties of grains by those that have proved more profitable. (2) Multiplication of improved seeds.

The total quantity of improved seeds issued to zamindars and cultivators during the year under report from the Government Seed Dépôts was, on sawai system 10,787 mds. (i.e. 9,872 mds. 16 srs. *rabi* and 914 mds. 24 srs. *kharif*) and on cash payment 2,970 mds. 28 srs. (i.e. 2,467 mds. 16 srs. *rabi* and 503 mds. 12 srs. *kharif*) making a total of 13,757 mds. and 28 srs. (or 12,339 mds. 32 srs. *rabi* and 1,417 mds. 36 srs. *kharif*). The financial position of the seed dépôts is highly satisfactory. A detailed report is being submitted separately.

District Board, Seed Dépôts, issued 3,903 mds. 36 srs. 8 ch. (i.e. 3,167 mds. 32 srs. *rabi* and 736 mds. 4 srs. 8 ch. *kharif*) on sawai system and 364 mds. 20 srs. (i.e. 345 mds. 37 srs. *rabi* and 18 mds. 23 srs. *kharif*) on cash payment.

The experience gained in the past shows that the system of issuing the seed on cash payment at the market price is more profitable to the seed dépôts than that of sawai. The latter is more advantageous to the cultivators and this is why they always prefer it. There is a very great demand for improved seeds from every district and this can be met with only by opening a large number of fresh seed dépôts in the selected centres. Hence I had proposed that a permanent advance of Rs. 50,000 as well as a temporary advance of Rs. 1,00,000 for five years may be allotted to the circle for seeds and implements to overcome the existing difficulties.

Cake Dépôts.—There are six cake dépôts in this circle, through which over 500 mds. of cake manures was sold to the cultivators during this year. Most of the cultivators who have realized the importance of these manures, now purchase them locally. Owing to the extremely dry year and the agrarian troubles, the demand for cake manure was very much limited. Where farm yard manure is not available in sufficient quantities or two or three bumper crops in the same year and the same fields are aimed at, the use of cake manure becomes quite indispensible.

V.—Miscellaneous work.

(a) Machines and implements.—A large number of enquiries for pumping plants and other power machinery was received during the year under report, but owing to high prices of the machinery and unfavourable exchange only two pumping plants and one power canecrusher were purchased by the Court of Wards, Partabgarh. Larger number of enquiries was for chaff-cutters and water-lifts. We supplied 146 Meston ploughs to various indenters besides some other implements and hand-tools. Scarcity of labour and the high charges demanded by the labourers bring the importance of agricultural machineries into prominence. The time has arrived when all kinds of approved machinery should be demonstrated on every large farm. The owners of private farms are most anxious to take machinery on hire from the department but we cannot meet this demand unless there is a separate stock of machines and implements for hiring out. Small workshops should be of great benefits to the agriculturists and should go far to remove the chief obstruction to the introduction of power plants and crushers, etc. Our little work shop did a very useful work in repressing the worn out and broken parts of the various machines supplied to zamindars in previous years.

(b) Agricultural shows.—Agricultural shows were held at Benares, Lucknow, Bara Banki, Ballia and Chunar in Mirzapur district. Demonstrations of improved seeds, implements and machinery, were given which were much appreciated by the public. Our special tractor demonstration was given at Lucknow and another at Fyzabad. The former was visited by His Excellency the Governor of these provinces and latter by Mr. Hailey, Commissioner, Fyzabad division, accompanied by certain interested zamindars. Lectures on agricultual subjects were also given by officials of the department during the show days and want of a separate set of machinery and implements for agricultural shows is keenly felt.

(c) Monthly agricultual Journals.—The *agricultural journals* (1) *mufidulmazarin* in Urdu and (2) *kisanupkarak* in Nagri were regularly issued throughout the year. The total number of articles appeared in them was 103 and that of their circulation has gone up to 1,169. I am glad to note that in spite of the agrarian troubles the circulation of the journals has increased and that its articles appeared in several other vernacular papers.

(d) Co-operative Societies.—Relations between the societies and the department were maintained more closely and more indents of *rabi* and *kharif* seeds were received from various Banks. About 100 mds. of improved *rabi* seeds was advanced to 9 Co-operative Societies in Ghazipore district alone. Report from Mr. Jawahir Lall Sinha, Honorary Manager of the District Bank shows the extent to which the seeds supplied was appreciated by the members and also that of their willingness to sow the improved seeds in next *rabi* season.

(e) Court of Wards.— Partabgarh, Rae Bareli, Lucknow, and Ghazipur Court of Wards are taking keen interest in introducing agricultural implements among the estate tenants by opening farms, seed dépôts and encouraging improved implements. They also occasionally co-operated with the department in the work of field demonstrations.

(f) Boring work.—There were four borers under me during the year under report. Out of these the services of M. Liaqat Hussain have been placed at the disposal of the Benares Hindu University since last six months. The total number of borings done during the year under report was 49 and out of this 30 were successful. These borers have now been transferred to the staff of the Agricultural Engineer.

(g) Correspondence.—The total number of letters received and issued during the year under report were 2,896 and 3,976 respectively. This does not include those issued from camp which are 146 making the totals 2,896 and 4,122 respectively.

L. C. SHARMA, M.R.A.C., P.A.S.I., BAR.-AT-LAW,

Dated the 11th August, 1921. *Deputy Director of Agriculture.*

APPENDIX III A.

Report on the administration of Government Seed Dépôts in the Eastern circle for the year ending with 31st July, 1921.

1. *Number of seed dépôts and how financed.*—There are now 22 Government seed dépôts in this circle as per statement I which are financed by the permanent and temporary advances made to the Deputy Director.

Lucknow, Partabgarh, Rae Bareli, Benares and Nogawan (district Sultanpur) are financed out of the permanent advance of Rs. 15,000 and the rest 17 by the temporary advance of Rs. 50,000 held by Deputy Director from year to year.

2. *Objects.*—The objects of the seed dépôts are:—

(1) Replacement of the local inferior varieties of grains by those that have proved more profitable.
(2) Advancing seeds to zamindars and cultivators on easier terms in comparison with those generally prevailing in the locality.
(3) Multiplication of improved seeds.
(4) Introduction of novel seeds, well acclimatized, which are found quite suitable and very profitable for the locality.

3. *Seed stock issued.*—The quantity of superior and improved seeds issued from Government seed dépôts during the year under report was 10,872 maunds, 14 seers, 9 chataks (viz., 10,021 maunds, 20 seers, 1 chatak *rabi* and 850 maunds, 34 seers and 8 chatak *kharif*) and that sold away on cash to various indentors was 2,448 maunds, 2 chataks rabi and 437 maunds, 13 seers, and 5 chataks kharif making a total quantity of all seeds issued to 13,757 maunds, and 28 seers. All the seeds produced on our farms are transferred to seed dépôts at the market rates. Thus a portion of the seed stock in seed dépôts is annually renewed. The seeds are issued either on sawai system or cash payment. The former is more favourable to our customers and in fact is highly appreciated by them. Pusa 12 wheat and superior varieties of gram, barley and paddy attract more attention of the growers than any other seeds. There was a great demand for opening fresh seed dépôts and increasing the stock in those already existed. It is not possible to give any accurate idea of the extent to which the inferior varieties have been replaced by the more profitable ones, but arrangements have been made to collect this information.

In the figures of the Administration report 129 maunds 28 srs, 3 ch. of rabi seed stock have by an oversight been shown under kharif stock. The difference of 19 maunds 15 srs, 14 ch. in the rabi cash figures and that of 65 maunds 38 srs. 11 ch. in those of the kharif cash is due to their being treated as sawai at the request of the customers concerned after the statements for the Administratian report were sent up.

4. *Seed dépôt buildings.*—Out of 22 there are only four Government seed dépôt buildings (at Partabgarh, Nogawan, Kadipur in district Sultanpur and at Fyzabad) out of which those at Partabgarh and Nogawan are pucca ones while all the others are kuchha taken on rent. It is highly desirable that there should be pucca buildings, at least for all the central seed dépôts. Such an investment effects a great saving in losses, caused by weather and insect pests, to the seed stock stored in kuchha houses and the amount invested can soon be made up by the enhanced profits of the seed dépôts on this account. The fact that our four seed dépôts costing about Rs. 9,000 were constructed out of the temporary seed dépôt profits, bears testimony to what I have said above, should a proof be needed.

5. *Staff.*—There is a moharrir for every seed dépôt who has got under him one, two or more peons according to requirements. The work of the moharrirs is supervised by the District Agricultural Superintendents and regularly checked by the Seed Dépôt Overseers and the District Agricultural Superintendents.

6. *Auditing control over the advances.*—There are two kinds of advances *(a)* permanent and *(b)* temporary. The former is audited by the auditors of public funds accounts and the latter, which is only from year to year, by the Deputy Director of Agriculture, occasionally through his District Agricultural Superintendents concerned and the Seed Dépôt Overseers as well as his office and also directly at least once a year. The latter is not audited by the Auditors of Public funds accounts as Deputy Director is personally responsible to refund it immediately on the expiry of the time for which it was advanced. It may not be out of place to mention here that the period of the temporary advance against me expires by the 30th of September, 1921. Unless a further extension is given for a year, for which I am applying separately, all the amount of temporary advances will be refunded within 20 days. An amount of Rs. 14,585 which will still be left in my hands on account of the temporary seed dépôt profits alone (to run a few seed dépôts out of profits alone), brings credit to all the officials concerned, specially the Seed Dépôt Overseers and the soundness of the management.

7. *Financial position*:—The financial position of all the seed dépôts, as is clear from the consolidated balance sheet herewith submitted, is absolutely sound. The subsidiary statements of the balance sheet deal with the demand (quantity to be recovered) collections and balances etc. of every seed dépôt separately and I am glad to note that in spite of unfavourable season, failure of crops and agrarian troubles in this part of the country, the recoveries of every seed dépôt excepting those of Ballia, Bara Banki and Badshahnagar where cholera epidemic was reported to prevail in the year under report, are highly satisfactory. And

although all the seed dépôt expenditure including pay of the staff etc. is borne by the seed dépôts themselves and also that in preparing the balance sheet the seed stock etc. in hand is valued at considerably easier rates so as to leave a good margin for any unforeseen losses yet there is a clear profit of Rs. 14,585 at least, on the business out of the temporary advances alone.

8. *General.*—It needs no antecedent now to prove that the seed dépôts working on well-organised lines are a paying concern and that 'more the seed stock, the higher the profits,' is the fundamental principle of this business. The system of making temporary advances for a year only is unfavourable to the desired progress of the business. In this connection, I may refer my proposals submitted last year regarding fresh permanent and temporary advances. I am sure that in introducing more seed dépôts in localities where there is a great demand for improved seeds, department will not be losing any money at all, in fact will make some good profit. It is not however for profits but the immense benefit which the zamindars and cultivators actually derive from the seed dépôts, that I had submitted the proposals for making fresh advances.

L. C. SHARMA, RAI BAHADUR,
M.R.A.C., P.A.S.I., BAR-AT-LAW,
Deputy Director of Agriculture,
United Provinces,
Eastern circle.

Dated the 29th August, 1921.

STATEMENT I.

Showing the number of the Government Seed Dépôts and the places where they exist.

Financed out of permanent advances.	1.	Lucknow.
	2.	Partabgarh.
	3.	Rae Bareli.
	4.	Nogawan (district Sultanpur).
	5.	Benares.
	6.	Badshahnagar (Lucknow).
Financed out of temporary advances.	7.	Malihabad (,,).
	8.	Juggaur (,,).
	9.	Bara Banki.
	10.	Amethi (Sultanpur).
	11.	Gaurigani (,,).
	12.	Kadipur (,,).
	13.	Sultanpur.
	14.	Fyzabad.
	15.	Antu (Partabgarh).
	16.	Derwa (,,).
	17.	Badshahpur (Jaunpore).
	18.	Ghazipore.
	19.	Ballia.
	20.	Bisandarpur (Mirzapur).
	21.	Chilh (,,).
	22.	Kachhwa (,,).

Balance Sheet of the Provincial Seed Dépôts as it stood on 31st July, 1921 (1328 fasli).

Serial no.	Particulars.	Amount.	Remarks.
	Liabilities.	Rs. a. p.	
1	To Temporary advance	50,000 0 0	
2	,, Reserved fund to meet losses	2 000 0 0	
3	,, Subscription	875 0 0	
4	,, Reserved fund to meet emergencies	2,000 0 0	
5	,, Cake Dépôt and other accounts (Rs. 1,222-5-3 plus Rs. 990-8-0.)	2,212 13 3	
	Total ..	57,087 13 3	
	profit ..	14,585 3 7	
	GRAND TOTAL ..	71,673 0 10	
	Assets.		
1	By cash balance in Treasury on 31st July, 1921	3,131 11 6	
2	,, Advances	4,843 15 11	
3	,, amount of receipt not credited up to 31st July, 1921 (in tahsils Rs. 4,639-6-3, credited in August, Rs. 2,600-2-10, with officials Rs. 6,188-3-0 and with moharrirs Rs. 514-5-1)	13,942 1 2	
4	,, valuation of stock including purchased *kharif* seeds ..	1,295 9 11	
5	,, valuation of stock including purchased *rabi* seeds ..	18,272 10 1	
6	,, outstanding for 1328 Fasli	4,768 0 1	
7	Ditto 1327 ,, ...	2,474 7 9	
8	Ditto 1326 ,, ...	10,045 11 8	
9	Ditto 1325 ,, ...	2,313 15 7	
10	Ditto 1324 ,, ...	898 3 0	
11	Ditto 1323 ,, ...	244 2 10	
12	Ditto 1322 ,, ...	168 9 5	
13	Ditto 1321 ,, ...	250 2 5	
14	Ditto 1319 ,, ...	63 12 0	
15	By valuation of four seed dépôts buildings	9,000 0 0	
	Total ..	71,673 0 10	

Balance sheet of the Permanent Seed Dépôts as it stood on 31st July, 1921 (1328 Fasli).

Serial no.	Particulars.	Amount.	Remarks.
	Liabilities.	Rs. a, p.	
1	To permanent advance	15,000 0 0	
	Total ..	15,000 0 0	
	Profit ..	4,203 15 11	
	Grand total ..	19,203 15 11	
	Assets.		
1	By balance in treasury on 31st July, 1921	7,750 5 9	
2	By receipts not credited up to 31st July, 1921	316 12 0	
3	By valuation of stock	7,342 2 6	
4	By valuation of outstandings for 1326 Fasli	1,668 4 4	
5	By valuation of outstandings for 1327 Fasli	2,126 7 4	
	Total	19,203 15 11	

APPENDIX IV.

Report on the administration of the North-Eastern circle of the department of Agriculture, United Provinces, for the year 1920-21, *by* MR. W. N. HARVEY, M.S.E.A.C., *Deputy Director of Agriculture.*

Staff.—Rai Sahib Ganga Prasad held charge of the circle until my return from leave on 26th January. I held charge for the remainder of the year.

During the year three new members of the Subordinate Agricultural Service were appointed on probation, having taken the two years' course at the Agricultural College, Cawnpore. This brings the total strength of the staff of the Subordinate Agricultural Service in this circle up to nine, all of whom have been recruited since October, 1917. Two additional fieldmen have been appointed. One fieldman has been lent to the Balrampur estate, leaving a total of five fieldmen attached to this circle. There has been no change in the ministerial staff during the year.

Farms.—No change has been made in the number or area of the Government farms in this circle. The management of the Balrampur estate farm was handed back to the estate, since the latter failed to fulfil the agreement made regarding the erection of buildings. The sum of Rs. 6,000 advanced by the estate to cover the first year's expenditure was returned to the *raj* as agreed, and over and above the sum of Rs. 7,000 granted by the estate to meet the cost of running the farm for the second year, a gross profit of Rs. 3,088 was returned to the *raj* representing the profit made during that year.

District work.

Wheat.—During the year under report 700 maunds Pusa no. 12,190 maunds Pusa no. 4 and 91 maunds of Cawnpore 13 were distributed. Pusa no. 4 did well on the Gorakhpur experimental farm and the Bahraich district farm, but further investigation is necessary before any new variety can be recommended with confidence to cultivators to replace the indigenous varieties.

Sugarcane.—Owing to an attack of red rot among some of the varieties of cane it was thought advisable not to distribute any cane grown on the Gorakhpur farm for seed to cultivators, and therefore the amount of sugarcane distributed for seed only amounted to 368 maunds, the bulk of which was obtained from cultivators who had been supplied with seed the previous year and whose crop, on inspection, proved to be healthy.

Miscellaneous.

1. Rice, maize, gram, *juar*, and groundnuts were all distributed in moderate quantities.
2. During the year 45 ploughs and one chain pump were sold to cultivators, but owing to the high prices which ruled throughout the year the demand for implements of all kinds was negligible.
3. *Correspondence.*—The total number of letters received and issued during the year was 1,324 and 1,513 respectively. These figures do not include demi-official correspondence.

W. N. HARVEY,
Deputy Director of Agriculture,
North-Eastern circle.

APPENDIX V.

Report on the administration of the Sugarcane Research Station, Shahjahanpur, for the year ending 30th June, 1921, by KHAN SAHIB MUHAMMAD NAIB HUSAIN, *personal Assistant to Director for sugarcane reasearch.*

I worked the Shahjahanpur sugarcane research station under the personal supervision of the Director during the year under review.

This station continues to perform the important functions of providing facilities for testing the comparative value of the different varieties on a field scale and for observing the modifications introduced by environmental conditions.

The chief lines of work of this station include trials of—

(*a*) indigenous varieties,

(*b*) varieties produced at Coimbatore and found suitable for field trials on experimental scale ;

(*c*) Foreign varieties imported cane.

The importance of experimental work in these directions justifies the attention which this station receives from the public and Government. It was honoured by a visit in January last from His Excellency the Governor of these provinces.

The experiments conducted so far have established that among medium canes serial no. 48 is the best both as regards tonnage and sucrose contents. It has given as much as 1,000 maunds of cane per acre when shown in shallow trenches and 900 maunds when planted on flat ground in lines four feet apart. The cane contained 12·25 per cent. sucrose per 100 cane.

This variety has been very popular with the sugarcane-cultivators of the locality, who have irrigation facilities and demand for its seed exceeds by far the supply available at the farm.

Of the thin canes A. 42 has proved its superiority having yielded 600 maunds cane per acre with 12·1 per cent. of sucrose per 100 cane.

In addition to the experiments on sugarcane, other crops also have to be sown in order to maintain the proper system of rotation. During the year an area of 14 acres was put under Pusa wheats and despite the high westerly wind at the ripening time which reduced the yield of wheat throughout the provinces an average outturn of 26½ maunds to an acre was secured with only one irrigation.

The following figures compare the income and expenditure of the farm. It is very satisfactory to notice that in spite of the highly scientific nature of the experiments which necessarily involve a good deal of unproductive expenditure, this agricultural station not only pays its way but shows a substantial margin of profits.

	Rs.
Income credited into treasury	15,438
Expenditure drawn from the treasury	8,500
Profit	6,938

M. N. HUSAIN,
Personal Assistant to
Director for Sugarcane Research.

APPENDIX VI.

Report on the administration of the Agricultural College, Cawnpore, for the year, 1921-22 *by* Dr. H. E. ANNETT, D. Sc., F.I.C., M.S.E.A.S., *Officiating Principal.*

I.—Staff.

The permanent Principal of the College, Mr. G. Clarke, only held charge of the post from 19th November, 1920, to February 19th, 1921. Previous to that he had been on special duty with the Government of India and since 20th February, 1921, he has been officiating as Director of Agriculture.

Mr. Youngman, Economic Botanist to the Government of the United Provinces, officiated as Principal during July, 1920, and during the remainder of the year under report I officiated as Principal, in addition to my duties as Opium Research Chemist.

Khan Saheb M. Abdul Qayum held charge of the post of warden throughout the year in addition to his post of Assistant to the Principal and Superintendent of the College Farm. The bestowal of the title of Khan Saheb on him in the last Birthday Honour's list was a fitting reward for his long and efficient services to the department.

The appointment of Mr. P. B. Richards as Entomologist to the Government of the United Provinces was made during the year under review and it is anticipated that assistance will be received from him in the ensuing year in directing the teaching of Entomology.

Dr. T. M. Singh joined the post of Assistant Agricultural Chemist to the Government of the United Provinces in October, 1920, and from February, 1921 officiated as Agricultural Chemist to the Government of the United Provinces and as such directed the teaching of Chemistry.

Mr. P. K. Dey, Plant Pathologist to the Government of the United Provinces, commenced during the year a useful course on plant disease to the 3rd and 4th year students and these will in future become a regular part of the course.

It is, however, to be deeply regretted that another year has been passed in review without the appointment of an officer to the permanent charge of the agricultural teaching. This is the most pressing immediate need. The want of such an officer throws much extra work on the Principal, especially in view of the fact that a new estate is under acquirement and has to be developed. Moreover, as will be shown later in this report, there is no lack of the right material in the form of students in these Provinces and, therefore, no effort should be spared to render the teaching at the College efficient.

II.—Examinations.

Two years examinations were held within the period under report. Owing to an outbreak of plague the 1920 examinations could not be held in April but were postponed to July.

THE 1920 EXAMINATIONS.

Diploma or four years course.

Twelve students sat for the Final Examination and 10 passed.

Of the 10 students who passed seven were taken into the department and two being State students received employment in their own States.

Vernacular or two years' course.

Twenty-one students sat for the Final Vernacular Examination and 19 passed.

Of the 19 students who passed, 12 were taken into the department.

The external Examiners were—

Agriculture.—W. Roberts, Esq., B.SC., Principal, Punjab Agricultural College, Lyallpur.

Botany.—The Economic Botanist to Government of the Punjab.

Chemistry.—B. H. Wilsdon, Esq., B.A., Agricultural Chemist to Government of the Punjab.

THE 1921 EXAMINATIONS.

The results of the Final Diploma and Vernacular Examinations must be considered exceedingly satisfactory.

Fifteen students sat for the Diploma Examinations and all passed.

Seventeen students appeared in the Final Vernacular Examinations, of whom 15 passed and two failed.

Details of the employment of these passed students cannot be given here since the appointments to the department have not yet been announced.

The External examiners were—

Agriculture.—M. W. Sayer, Esq., Imperial Agriculturist, Pusa, Bihar.

Chemistry—C. S. Taylor, Esq., Agricultural Chemist and Prinicipal, Agricultural College, Sabour.

Botany.—R. S. Hole, Esq., Forest Botanist, Forest Research Isntitute and College, Dehra Dun, U. P.

Book-keeping and Accounts.—R. Menzies, Esq., C.A., Cawnpore.

III.—Applications for admission.

There would seem to be a considerable demand for agricultural education in these provinces judging from the number of applications received for admission. The Vernacular course seems particularly popular. To a certain extent this is possibly due to the fact that

it is a two years' course only and a certain proportion of applicants for this course would be suitable for admission to the four years' course. Further the College seems popular outside these provinces since numerous applications are received from Native States and even from other provinces.

A careful analysis of the applications shows that the majority are from students directly connected with the land, their fathers being either large land-holders or actual cultivators.

There is, moreover, a sprinkling of the better qualified student among the applications. Thus three students under admission to this year's Diploma course hold the Intermediate Science qualifications.

One-hundred and fourteen applications have been received for the Vernacular course and 52 for the Diploma Course.

Thirty-three of the former and 25 of the latter have been admitted. Many more were eminently suitable for admission but could not be taken owing to lack of boarding-house accommodation.

IV.—Openings for passed students.

Apart from the demand for passed students in the department itself if it undergoes the expansion anticipated, a good proportion of our students appear to desire to look after their own land. Thus among the 58 students admitted to the coming session 14 state that their object in coming to the College is to improve their own land. Eight students are being sent by large zamindars who wish to employ them after they have qualified. We have several applications from zamindars and others for passed students to assist them in managing estates. There are several other directions in which our passed students may look for employment. Several moreover are attempting to obtain admission to European agricultural institutions for higher training after they have qualified here.

V.—Extension schemes.

The practical agricultural teaching has hitherto been carried out under a big handicap owing to the unsuitability and small area of the existing farm. The College Dairy has moreover hindered the farm considerably owing to the fact that fodder had to be produced on the farm for the dairy animals.

Arrangements for the acquirement of 381 acres of land adjacent to the College are now almost complete. This will enable the students to have land for their own cultivation and will provide an opportunity for students to see the management of a compact farm. It will moreover enable the dairy to be self-containing in that it will have its own farm attached to it.

It should be pointed out, however, that men of actual practical experience will be required to staff this farm and no effort should be spared to select the best men from the existing district staff.

A new dairy building is under construction and approaching completion.

Money has been allotted to enable a beginning to be made with the extensions of the College building.

Proposals are before Government for the provision of more boarding-house and dining hall accommodation. These are urgently needed, since students are being annually refused admittance to the College on account of want of accommodation for them.

A scheme for the provision of six lecturers' quarters has been sanctioned. These quarters are very urgently needed.

VI.—Univesity affiliation.

The question of affiliation of the College to a university arose during the year. A report on the subject was submitted by me. The matter is being considered by a committee appointed by Government.

H. E. ANNETT,

Principal, Agricultural College, Cawnpore, United Provinces.

Dated the 28th July, 1921.

APPENDIX VII.

Report on the administration of the Chemical section for the year ending 30th June, 1921, by MR. HAR NARAIN BATHAM, M.A., *Officiating Agricultural Chemist to Government, United Provinces.*

DURING the year under report the office of the Agricultural Chemist to Government of United Provinces had been under three officers, Mr. Clarke being appointed by the Government of India as a member of the Indian Sugar Committee went away to Java and Pandit Tej Shankar Kochak, B.A.S.C., remained in charge of the section as Officiating Agricultural Chemist to Government, United Provinces, till the 15th November, 1920, when Mr. Clarke returned and took over charge of the office.

Dr. T. M. Singh, PH.D., was appointed Assistant Agricultural Chemist to Government, United Provinces, from the 4th October, 1920.

Again, on the 20th February, 1921, Mr. Clarke had to leave this section on his new appointment as Director of Agriculture, United Provinces, and the charge was given to Dr. Singh, Mr. S. C. Banerjee, F.C.S., 1st Assistant to the Agricultural Chemist to Government, United Provinces, being appointed Officiating Assistant Agricultural Chemist to Government, United Provinces.

There has been no change in the teaching staff this year, except the appointment of Dr. T. M. Singh as Assistant Agricultural Chemist, who used to lecture on Chemistry in place of Mr. Clarke.

The college is full and the teaching of Chemistry and Physics was carried out on the lines laid down in the past years, except that few practicals on enzyme chemistry were newly introduced in the third-year class and one student was admitted in the fourth year to learn the chemistry of sugar. The two years' course continued as usual.

The Research work at Shahjahanpur farm continued as last year and on the 20th February, 1921, the farm along with the services of Mr. S. C. Banerjee, F.C.S., were transferred under the direct control of the Director of Agriculture, United Provinces.

Dr. T. M. Singh started the determination of CO_2 in United Provinces soils and samples from different parts of the province were taken and analysed ; but the results are incomplete as yet.

CAWNPORE,
The July, 1921.

H. N. BATHAM, M.A.,
Offg. Agricultural Chemist to Government, United Provinces.

APPENDIX VIII.

Report on the administration of the Botanical section for 1920-21 *for the year ending* 30*th June*, 1921, *by* MR. P. K. DEY, M.SC., *officiating Economic Botanist to Government, United Provinces.*

IN absence of Mr. W. Youngman, on leave, this report was drawn up by Babu Rama Prasad, in collaboration with Messrs. R. V. Damley and M. G. Phatak.

Charge.—During the year under report Mr. W. Youngman remained in charge of the office of the Economic Botanist to Government, United Provinces; Babu Rama Prasad held charge of the current duties of the Assistant Economic Botanist till the 27th May, 1921, when he was appointed Officiating Assistant Economic Botanist to Government, United Provinces. Mr. Youngman also held charge of the Botanical section of the college. He carried on teaching of the Diploma and Vernacular classes with the help of his lecturing assistants Messrs. Damle and Phatak. During the year under report, however, on account of the pressure of work in connection with cotton survey he could not devote much time to his class work and had to leave some of his lectures to his assistants.

Cotton.—As laid down in last year's report the botanical section was engaged in carrying out the cotton survey of the indigenous cottons of the province and the collections made from Moradabad civil district were grown and studied this year. A note of the work carried out there and subsequently at Cawnpore is appended herewith. Detailed selection from Saharanpur district was also made this year. About 900 samples were collected from different parts of the district. Of these, 378 single-plant collections and about 120 mixed samples, showing some desirable lint characters, were retained and kept apart for careful study. Some of these Saharanpur collections were observed to possess lint measuring 7/8 to 1" and of soft and silky texture. About 500 samples of the cotton from Saharanpur are being grown at Cawnpore in the season 1921-22 for systematic analysis and selection and to see if the desirable lint characters observed in certain cases remain constant under changed conditions of Cawnpore. Hybridization work with certain forms of *Gossypium cernuum* was carried on. Some promising types with fairly long lints and high ginning values were tested for purity. Selection work in Perso-American cotton also went on and this type is now undergoing trial on big scale.

Sesame (*Sesamum indicum*).—The collection of '*tils*' which was being grown at the botanical area has been classified into various groups according to the colour of their seed coat and maturation period. They will be studied this year to see if they remain pure and the range of variation in colour will be investigated in cases where they split up.

Ricinus communis.—A small collection of castor seeds from Bundelkhand was obtained and these have been sown to study their differences and also with the view of finding out a type possessing high oil-yielding quality.

Wheat.—Cawnpore 13 was grown and the yield per acre tested on the various plots. The highest yield per acre was 35 maunds and 27 seers, and the average for 18 acres was 27 maunds and 14 seers per acre. Attempts are being made to encourage its cultivation in the Muttra district.

Barley.—Investigation work on the effect of moisture on stored barley was completed and the results will be published in a bulletin.

Raya Seed Farm.—This farm is now in full working order. Considerable amount of levelling work however has still got to be done. About 14 acres in this farm were under wheat. Gram for fodder was grown on 26 acres and 15 acres were under barley. Peas were also raised on 39 acres.

About 48 acres are under cotton this season (1921-22) which is being tested for yield and quality on big scale. Over half of this area is under Perso-American type which is being tested on field scale. The seeds of most of these cottons were sent out from Cawnpore experimental farm.

P. K. DEY,
Officiating Economic Botanist to Government,
United Provinces.

APPENDIX VIII (*a*).

A note on the indigenous cottons of the Moradabad Civil district, United Provinces.

(*By* W. YOUNGMAN, *Economic Botanist, and* RAMA PRASAD, *Officiating Assistant Economic Botanist, United Provinces.*)

THE Indian Cotton Committee in their report issued in the spring of 1919, amongst several recommendations with regard to the United Provinces, advised "A detailed survey of the indigenous cottons of the provinces should be carried out at once, selections being made at the the some time which should be tested on the Government farms." (See Indian Cotton Committee report, page 58, section. 6). As a result of this recommendation the Economic Botanist was instructed by the Director of Land Records and Agriculture, United Provinces, in his no. 1207-C., dated the 16th May, 1919, that his department should, if possible, commence the work at once and that in view of the local reputation enjoyed by the cottons of the Saharanpur and Moradabad districts these areas might be examined first. These instructions were further endorsed by the United Provinces Government in their resolution, Revenue department, no. 1289/I, dated the 4th June, 1919, in which His Honour the Lieutenant-Governor decided "That arrangements will be made to carry out the survey under the direction of the Economic Botanist at the Raya Cotton Farm and other selected farms in the cotton tract."

Four members of the Subordinate Agricultural Service, in addition to the Economic Botanist's usual staff, were allocated for this work. The work was accordingly commenced in the Moradabad district in the cotton season of 1919. It was found that with the staff at our disposal this one district was all that could be investigated in that season. An actual start was made on 5th August, 1919, at Moradabad, on the lines of the following plan :—

All the staff were to go to the six tahsil headquarters and refer to the tahsil records and in consultation with the kanungos make out a detailed list of villages growing cotton and a touring programme through the tahsils. Owing to limitations of staff only two tahsils at a time could be visited. In a way this limitation was a disadvantage, as some tahsils were seen early in the season and others, later. The lints of the crops were thus not seen perhaps to full advantage in the case of those first visited but no other method with the limited staff was possible. On reaching a particular village a general idea of the cotton crop was recorded, the prominent features, if any, were noted, the various strains growing there were ascertained and an opinion made roughly as to the proportion of the different types. An examination on the spot as to the characters of the lint was made. The staff was provided with a record form in which they entered of each crop details as to the flower, colour, the character of the leaf, any local reputation for cotton and origin of seed if known. In cases where the quality of the lint appeared above the average, samples were collected and sent to Cawnpore. These samples were subjected to more critical examination and after making eliminations those with desirable characters were selected and set aside to be tested by field experiments in the season 1920.

General observations:—Moradabad district is divided into six tahsils: Moradabad, Thakurdwara, Belari, Sambhal, Amroha, and Hussanpur.

The following statement gives the number of circles and villages in the tahsil and numbers visited by the staff: —

TABLE 1 (A).

Tahsil.	Circle.	Number of villages in circle.	Number of villages visited.
Moradabad ,, ..	Moradabad ,, ..	320	253
Belari ,, ,, ..	Seondara	142	142
	Kundarki ,, ..	175	167
	Chandausi ,, ..	135	132
Sambhal ,, ..	Bhur ,, .. ,,	146	84
	Sirsi	126	112
	Babjohi .. ,, ..	124	116
	Asmauli .. ,, ..	143	135
Thakurdwara ,, ..	Western ,, ,, ..	158	140
	Eastern ,, ,, ..	169	139
Amroha ,, ..	Diduli, Kanth, Amroha ,, ,,	568	481
Hasanpur ,, ,,	,,	..	20
Total ,,	,, ...	2,206	1,921

The cotton area of the Moradabad district generally averages about seven per cent. of the *kharif* area. In the year under report the actual area under cotton according to the season and

crop report was 56,229 acres, or 11·7 per cent. of the entire *khrif* area. The acreage under cotton was thus exceptionally high. The examination of survey sheets as filled up by the staff discloses the fact that the yellow-flowered, narrow-lobed leaf-type of *Gossypium neglectum* is the general predominant form found throughout the district. The other three forms, white-flowered narrow-lobed leaf, yellow-flowered broad-lobed leaf, and, white-flowered broad-lobed leaf constitute a proportion varying very much in different areas. The total of these may be as low as 2 per cent. or as high as 30 per cent. As we have only grown these so far for one season we have refrained from attempting to name them more definitely in view of the fact that in another season some may split up showing themselves to be crosses. A more detailed knowledge of the areas and proportions in which different types are scattered is, if possible, desirable in the surveys of districts undertaken in the future. Such information is not the easiest to obtain. The possibility of the occurrence of local races was a point to which the attention of the staff was particularly directed. In addition to the main types mentioned, small traces of *Gossypium hirsutum*, *Gossypium intermedium*, and broad-lobed *Gossypium neglectum* with khaki lint were found. Their proportion to the general crop was negligible.

Staple.—From the point of view of staple it may be said that no definite tract or locality was found in which any marked superiority above general conditions existed. Plants with high ginning percentages of lint and longer staples when found only occurred scatterd amongst the general crop. In no case did any indigenous individual crop uniformly show a superiority. In these respects the cotton crops of this district were disappointing. Any improved crop had invariably been introduced from outside by departmental or other agency.

Individual longer and softer-linted plants always gave lint with lower ginning values. Softness when found was almost always associated with yellow-flowered plants. Names of villages and circles where better staples occurred are given in the list below. In addition, the results of field trials of many of their progeny in the season 1920 are also given.

TABLE B.

Field trials of cotton of the Moradabad civil district.

B=Broad; I=Intermediate; N=Narrow; Y=Yellow; W=White.

In some cases the numbers of flowers and leaf counts do not represent all the plants raised.

Names of village of the origin of sample.	No. of plants raised.	Counts made of flower and leaf characters.		No. of selections made on habit and lint.	Ginning per cent.
		Leaf.	Flower.		
		B. I. N.	Y. W.		
Baradi	7	0 0 7	7 0	1	28
				2	25
				3	24
				4	29
Bariwala	4	1 1 2	3 1	1	25·5
Coksi	6	0 1 5	6 0	1	29
Papri	9	0 1 8	9 0	1	26
Baroda Fatehullahpur	8	0 0 8	8 0	1	28·5
				2	30
				3	25
Bhankri	9	3 3 3	9 0	1	30
				2	30
Sikanderpur	8	0 1 7	7 0	1	22·5
				2	25
Salempur	10	6 1 3	5 4		
Garhi	9	0 1 8	7 0		
Raipur Kalan	15	5 3 7	15 0	1	28
				2	30
Rajapur	6	0 1 5	6 0	1	22
				2	29
Munawarpur	5	5 0 0	0 5	1	33
				2	33
Adampur	4	2 0 2	4 0		
Budanpur	5	2 0 3	3 2	1	30
Phulpur	3	1 2 0	3 0		
Pota	5	0 0 5	0 5		
Hashimpur	5	0 1 4	5 0		
Hazirpur	7	0 0 0	6 1	1	28
				2	29
				3	28
Khanpur	5	1 1 3	5 0	1	25
				2	28
Zamaina Khurd	5	0 1 4	5 0	1	25·5
Dehri Jaman	4	0 1 3	2 2		
Kazi Khera	5	0 0 5	5 0	1	29
				2	25
				3	27
Rampur	1	0 0 1	1 0	1	24
				2	24
				3	25

Names of village of the origin of sample.	No. of plants raised.	Counts made of flower and leaf characters.					No. of selections made on habit and lint.	Ginning per cent.
		Leaf.			Flower.			
		B.	I.	N.	Y.	M.		
Sadoli	5	0	0	5	5	0	1	28
Amroha	88	24	17	46	51	8	1	27
							2	27·5
							3	26
Mundhan	8	2	1	5	3	1		
Sirsi	74	11	13	50	50	10	1	30
							2	25
							3	35
							4	31
							5	36·5
							6	26
							7	26·5
							8	25
Gasainpur	5	1	3	1	4	0		
Chokra	2	0	0	2	2	0	1	26
							2	24
Bhur, mixed	19	2	5	12	17	1	1	30·5
							2	27
							3	28
Gajrola	9	3	1	5	8	0	1	23
Shahbazpur	3	0	0	3	3	0	1	28
							2	28
Tokra Hasanpur	5	1	3	1	4	1		
Sahsoli	2	0	0	2	2	0		
Hasanpur mixed	14	2	1	11	6	3	1	30
							2	27·5
Seondara	5	0	0	5	5	0	1	30
							2	27
Chakorpur Memri	4	1	3	0	2	0		
Sambhal mixed	18	1	2	15	14	3	1	25
Bahjohi no. 1	5	0	1	4	5	0		
Ditto 2	4	4	0	0	2	0	1	26·5
							2	31
							3	27
Ditto 3	4	4	0	0	2	1	1	33
							2	28·5
							3	31
Chandausi	5	0	0	5	5	0		
Mixed simple Belari	38	0	2	36	22	13		
Ditto Thakurdwara eastern	37	10	8	18	26	6	1	26·5
Ditto Kashipur *	35	17	4	14	26	2	1	29
							2	25·5
							3	24·5
							4	32·5
Mixed Thakurdwara western	35	14	11	10	30	2	1	25·5
							2	25·5
							3	28·5
Mixed sample Moradabad	39	3	5	3	21	16	1	35
							2	32
							3	28
Ditto Seondara	20	2	3	13	19	1	1	28
							2	33
							3	33
							4	27·5
							5	36
Fatehpur Bashnoi	28	1	5	22	23	3	1	31
							2	27·5
Atrassi	20	6	1	13	12	7	1	30
Pachokra Maharban Ali	19	0	0	18	15	3	1	34·5
							2	31
Danpur	20	0	0	20	14	3	1	27·5

* Tract adjoining Thakurdwara, this belongs to the Naini Tal district.

SUMMARY.

Taking the province as a whole, the year under report was the best as regards quantity of cotton produced during the last seven years. In tahsil Thakurdwara, Moradabad district, the proportion of broad-lobed yellow-flowered plants was reported to be slightly higher than in other tahsils, yet as regards lint length it was nothing exceptional. Moradabad tahsil showed the shortest and harshest lints. In Belari tahsil a slight improvement over general conditions was found, but this gradually deteriorated in the areas towards Chandausi, where the lints become shorter and coarser. Speaking generally the cottons were disappointing both as regards length of staple and ginning percentage. From the product of our first year's field trials very little, indeed, shows any outstanding merit worthy of further selection and multiplication.

APPENDIX IX.

Administration report of the section of Plant Pathology for the year ending 30th June, 1921, by MR. P. K. DEY, M. SC., *Plant Pathologist to Government, United Provinces.*

Charge.—I remained in charge of the newly constituted section of Plant Pathology throughout the year, except from the 15th February to 15th March, when I went on privilege leave. I also held charge of the Plant Pathological section of the College during that period.

Staff.—No provisions were made for the staff either for my office or for research work.

Laboratory.—I was given a temporary accommodation in a room in the botanical section. Fitting up of this room as a workable laboratory had to be deferred till March, 1921, owing to late arrival of apparatus ordered from abroad.

Work.—The question of potato storage rot was taken in hand but owing to absence of proper laboratory and other facilities no critical work could be done. Preliminary field examination of the growing crop however was done in the potato-growing tracts of the plains, and a few collections made.

A small collection of mycological specimens for the laboratory was also made and on the strength of this I gave a course of lectures on Elementary Mycology to the Diploma students of the College. For this College work I had to depend on the kind help of the staff of the botanical section.

P. K. DEY,
Plant Pathologist to Government,
United Provinces.

APPENDIX X.

Report on the administration of the Entomological section for the year ending 30th June, 1921, by MR. P. B. RICHARDS, A.R.C.S., F.E.S., *Entomologist to Government, United Provinces.*

1. I assumed charge of the newly created post of Entomologist to Government, United Provinces, on the 18th March, 1921, with headquarters at the Agricultural College, Cawnpore.

2. *Staff.*—Other than office staff, there was no provision for the year.

3. *Laboratory.*—Temporary accommodation was provided in the botanical wing of the Agricultural College, Cawnpore.

4. Investigation of the insect pests of cotton was commenced. This will constitute the major work of the section in the year 1921-22.

PHILIP B. RICHARDS,
Entomologist to Government, United Provinces.

APPENDIX XI.

Report on the administration of the Agricultural Engineering section for the year ending 30th June, 1921, *by* MR. F. HOWARD VICK, M. I. MECH. E., *Agricultural Engineer to Government, United Provinces.*

During the year under review enquiries for all classes of agricultural machinery have been very numerous, the majority of the cases being for pumping plant for irrigation work. The failure of the monsoon in 1920 in this province accentuated the need for more certain methods of watering the fields, and the continually increasing costs of labour render the adoption of machinery for farming operations more necessary. Zamindars and farmers are anxious to go in for more machinery but at the same time are chary of investing money in uncertainties. They have to be convinced, and rightly so, of the usefulness and reliability of a machine before laying out money on it.

There is no doubt that India is far behind the other great agricultural countries of the world in the adoption of labour-saving machinery for farming operations, but for this state of affairs there are cogent reasons, and until these adverse conditions are overcome there will be no general adoption of such machinery in India.

Until a few years ago labour was so cheap in India that the necessity for machinery was not a vital question with farmers, but now that the cost has risen so enormously in recent years we may take it that many operations can be performed more cheaply, not to say expeditiously, by mechanical power. The very big demand for machinery, and the adoption of such on even a small scale points clearly to this conclusion.

One of the main reasons for the absence of machinery for farming work is the non-existence of manufacturing engineering firms in this country, at any rate of makers of agricultural machinery. In the case of say England or the United States immense numbers of manufacturing engineers are scattered over the length and breadth of the country, in every county and district. These are engineers in the true sense of the word; they manufacture the implements they sell and are quite ready to see the farmer through in any difficulties which occur in operation. Indeed they will send out men to instruct in the use of a machine and will undertake all repairs to their implements at very reasonable cost. It is this "seeing the thing through," in other words enterprise on the part of the manufacturer, that so helps the farmer, especially in the case of a new machine.

India on the other hand has no manufacturing engineers of agricultural machinery at all. The majority of firms calling themselves engineers are nothing but agents for foreign made implements, many of which are unsuitable to the needs of this country. Such firms will sell as many implements as they can for ready money, but once sold they are not concerned with the behaviour of the tool in the field and leave the farmer to shift for himself as regards repairs and replacements. But even with these agents a little more might be done perhaps, were it not for the fact that they are all established in the port towns of Calcutta and Bombay, some 600 to 1000 miles from most parts of this province. They are too far away to be at all in touch with the farmer, or to render him any useful help. They keep, with one or two exceptions, no experts to send out to the farmer to give him advice and help. It is therefore not to be wondered at that the farmer in this country, with experience of failure, is not over-anxious to buy machinery or implements, despite the need for such being felt by him.

Another reason militating against the adoption of machinery on a large scale in this country is the very small holding of the cultivator. As an example of this may be mentioned a village in which I installed a tube well. The area of the village included in the scheme was 100 acres and this embraced no less than 190 *khasras* or fields with separate revenue numbers. The average area of a field was therefore only about half an acre. This case, moreover, is not by any means exceptional. It is the rule, and these minute fields are uneconomical, from any agricultural point of view, for cultivation by machinery or for irrigation by mechanical power.

The disadvantage pertaining to the use of machinery for small holdings can to a certain extent be overcome by a large extension of co-operative societies in villages. Were it possible it would be to the immense advantage and prosperity of the province if a resettlement and re-allotment could be made with no field or holding of less than five acres. This would certainly lessen our departmental difficulties and no branch would benefit more than the engineering one. However this is a Utopia for which perhaps it is useless to aspire and it is therefore more necessary to adopt the principle of co-operation in the villages on a much larger scale as the only way of salvation.

From the foregoing remarks it will be seen that the backwardness of the province in the use of machinery is principally due to the lack of enterprising manufacturing firms and it is this lack which the engineering branch of the department is attempting to some extent to fill. In this line we have to do the work usually done by private firms in other countries, and of course we can never do it fully, it is beyond our resources.

However, to get work done on a bigger scale the engineering branch is under re-organisation. We are shortly building new workshops and offices on a very much enlarged scale. We shall, when the scheme is completed, be in a position to meet the needs of all enquiries for agricultural machinery and although we shall not be actual manufacturers of such plant we shall keep a stock of approved machines which have been found suitable for the work required of them.

Also the staff is to be much strengthened and it is hoped that by forming circles in the province and having a staff in each we shall be in very much closer touch with the purchasers and users of agricultural machinery. It is our aim to be responsible for the actual working of the machines we recommend or sell, and to undertake all repairs and replacements.

During the past year, owing to absence of plant and equipment, only 12 tube wells could be taken in hand, although there were enquiries and demands for over 150. Owing to unsettled labour conditions in England, there was great difficulty in getting orders for plant executed, and boring tubes ordered in June, 1920, only came to hand in April and May of this year; in fact the order took nearly twelve months to the delivery of goods, instead of three months, as in normal times. It is satisfactory to note that there is some little improvement lately both as to prices of goods and time of delivery, but the cost of all plant is still very much more than double the pre-war rates, so there is ample room for further improvement. These high prices are not favourable of course to the extended use of machinery and it is to be hoped that normal rates, more nearly to the pre-war, will soon again persist.

The district borers of the province have been placed under me from June of this year and I hope to extend this branch of work largely, and make it respond more to the needs of the cultivator. There is a demand always for the services of these borers but I am not at present sure that sufficient success is obtained with the work to justify the expense upon it. In the past there has been no means adopted to obtain the opinion of the well-owner as to the results whether satisfactory or otherwise from his point of view. The borers themselves have given the verdict as to whether success is obtained or not and of course this can scarcely be considered an impartial opinion. I am remedying this defect by getting into personal touch with each well-owner for whom work is done, and finding out if he is satisfied.

From the annual returns sent in by well engineers of the results of this district boring work, the following figures may be quoted. The number of wells bored during the year was 746, of which 518 are stated as "successful." The percentage of success is thus about 68.

In addition, 131 sites were bored for proposed new wells, and of these 84 are returned as successful, giving a percentage of success of 64.

There were 33 borers employed during the year on this district work and the total boring done in feet was 47,262.

The classes for students of the College, for the study and practice of mechanics and workshop methods, have have been run as usual throughout the year. The students have shown their usual keenness for gaining knowledge in this branch of work.

F. HOWARD VICK,

Agricultural Engineer to Government,

United Provinces.

APPENDIX XII.

Note on arboricultural operations during 1920-21.

Summary of work done.—Planting was done on 133 miles of local and 34 miles of provincial roads as compared with 177 and 39 miles respectively provided in the working plans. The 133 miles planted on the local roads include eight miles put in by private persons—in Basti (two miles) Fyzabad (two miles) and Bara Banki (four miles).

Planting of unsuitable trees has further been restricted during the year. The following are the details of such trees :—

	Saris.	Tun.	Semal.	Kachnar.	Bakain.	Total.
On Local roads	15	8	3	2	103	131
On Provincial roads	49	271	1	..	..	321

Most of the tun trees were planted in the hilly districts.

Working plans.—As far as local roads are concerned 28 out of the 48 districts carried out their working plans while divergence in varying degrees occurred in the remaining districts. The Dehra Dun district board had to give up the working plan, as the trees put down during the last three years had failed. Most of the districts report that departure from the plan was due to the scanty rainfall of the year and the increase in wages. Gap filling was done to a large extent specially on provincial roads.

Extension of avenues.

During the year under review 45 miles have been removed from recorded established avenues of the preceding year and 253 miles of new plantation added.

The net result is shown by the following figures :—

	Total length of established avenue at the end of 1919-20.	Length struck off.	Length added during the year.	Total length established.
Local	7,503	—7	+ 177	7,673
Provincial	2,313	—38	+ 76	2,351

Training of supervisors.—No training class of arboriculture supervisors was held during the year.

Financial results.—The following figures compare the income and expenditure for local and provincial roads during this year with those of the last year :—

	Income,		Expenditure,	
	1919-20	1920-21.	1919-20	1920-21.
	Rs.	Rs.	Rs.	Rs.
Local roads	64,554	88,259	1,48,672	1,52,096
Provincial roads	28,452	51,451	80,203	80,388

It is apparent from the above figures that the income has considerably increased while there has not been proportional increase in the expenditure with the result that the net expenditure has been reduced by Rs. 42,146 during the year as compared with the last.

ORDERS OF GOVERNMENT.

No. 369/XIV—173.

RESOLUTION.

FOREST (AGRICULTURE) DEPARTMENT.

Dated Allahabad, the 28th October, 1921.

READ—

Director of Agriculture's report on the administration of the Department of Agriculture for the year ending 30th June, 1921.

OBSERVATIONS.—The annual report of the Department of Agriculture for the year ending June, 1921, shows that a start has been made in carrying out the scheme of re-organization and development outlined in last year's report, but as in the case of some other departments the shortage of recruitment and the scarcity and high price of machinery due to the prevailing industrial unrest have considerably checked the rate of progress.

2. In the enlarged Legislative Council the keenest interest has been taken in the development of the Agricultural department and much shrewd criticism and valuable advice have been offered to the Director, and to the Government. It is, however, generally admitted that the department must be expanded as fast as the output of trained men and the provincial finances will admit, in order that agriculture, the chief industry of the United Provinces, may gain the full benefit of modern science, modern machinery and modern engineering.

3. During the year only three new officers were added to the provincial staff of the Indian Agricultural Service, one being appointed Entomologist and the other two being Deputy Directors. Of these three officers, two were recruited in England and the third was promoted from the Provincial Agricultural Service. As the latter was already in charge of a circle and Mr. Burt, the Deputy Director of the Central Circle, was lent to the Government of India, there were no surplus Deputy Directors available to carry out the scheme of expanding the present four circles into ten. So long as these four unwieldy circles continue, it is impossible to expect the Deputy Directors to exercise adequate supervision over widely scattered experimental and demonstration farms, or to give proper attention to the many local problems that call for expert investigation and advice. The Government hope that, at an early date, it will be possible to open three new circles; Fyzabad, Rohilkhand and Bundelkhand. During the year under report, twelve new posts were sanctioned for the United Provinces Agricultural Service and twenty new posts for the Subordinate Agricultural Service. The Agricultural Engineer's staff has also been strengthened by the addition of a second agricultural engineer and three assistants.

4. The number of applications received for admission to the Cawnpore Agricultural College shows that the demand for agricultural education is steadily growing and that the value of this education is appreciated by landowners. In all, one hundred and sixty-six applications for admission were considered by the Governing Body, of which

only fifty-eight could be admitted. Out of these, fourteen students joined the College with a view to learning how to manage their own estates and eight were sent by the owners of large properties who wish to employ them as land agents. During the year the Government appointed a Committee to consider the question of affiliating this College and the Thomason College, Roorkee, to the Allahabad University. The Committee has submitted a report recommending that the College should be admitted to the teaching side of the Allahabad University, and that its management should be made over to the University. The Government are awaiting the opinion of the Senate before passing orders upon this report but intend in any case to alter the present system under which two different types of agricultural education are given at the College. The first type is a four-year course of the standard required for a University degree, while the other is a two-year course which combines school work with agricultural training. The latter, as the Director points out, does not require the costly equipment and staff necessary for a University degree course and can be carried out equally well and far more cheaply at agricultural schools. In recognition of this fact, the Legislative Council have recently agreed to the establishment of an agricultural school at Bulandshahr where experiment will be made as to the course of study needed in such schools. The Government hope, in the course of the next few years, to establish several more agricultural schools, the equipment and training in which will be based on the experience gained at Bulandshahr. The discoveries and lessons of modern agriculture postulate a far higher standard of intelligence and education than that which is possessed by the ordinary cultivator. The possibilities of developing the agricultural resources of this province, so far as nature is concerned, are vast, but the first condition precedent to the realisation of these possibilities is the training of the rising generation in modern methods, so that they may teach and guide the uneducated rank and file.

5. The Director's report contains a most interesting chapter on the research work conducted on cotton, sugarcane and wheat. He illustrates the importance of the recently created Indian Central Cotton Committee, whose duty it will be through the agency of his department, to keep the cultivators in touch with the demands of the market in India and foreign countries. At present considerable criticism has been directed against the efforts which the Department has made to introduce into the dry tracts of the Western Circle a variety of cotton known as "Aligarh White-Flowered" which is the product of the investigations carried out by the Deputy Director of Agriculture of the Western Circle. The representatives of the local spinning industry complain that this cotton is of little or no value to them and that the department has been misdirecting its efforts in encouraging the spread of this variety in the special tract for which it is suitable. On the other hand the cultivator finds that he can get a better financial return from this variety and continues to grow it. There is no difficulty in selling it and agencies exist which are willing to give a good price for it. The Cotton Committee should be able to advise as to the probable demand for the type of cotton represented

by Aligarh White-Flowered and whether trade developments make it advisable to abandon all efforts to improve the yield of coarse short-stapled cotton.

6. As regards sugarcane, the most important event of the year has been the appointment of the Indian Sugar Committee whose report has recently been received after the close of the year. One of the most striking facts in that report is the extraordinarily small yield of sugar per acre of cane in India as compared with the yield in Java, Cuba and Hawaii, the other chief cane-growing countries of the world. The Committee have approved the lines on which research work on sugarcane is being conducted in this province and have made a large number of suggestions which will be considered as soon as possible by the Government. The experiments which have been made by the officiating Director at Shahjahanpur show that there is no reason why the yield of cane in this province should not be at least doubled. The Director quotes a remarkable estimate that, if the entire cane crop of India were crushed in modern mills and worked in central factories, an increased production of over one million tons of sugar would result.

7. The use of improved varieties of wheat, especially Pusa no. 12 and 4, continues to spread rapidly among the cultivators, and it is now estimated that some four hundred thousand acres are sown with these varieties, which at a modest estimate give the cultivator an increased return of Rs. 15 per acre. Expressed in money, this represents an extra gain of about 60 lakhs of rupees annually to the cultivators. The department is steadily increasing the number of seed dépôts where the cultivator can purchase the best varieties, and the Government have cordially accepted a resolution moved in the Council that the eventual aim should be to establish a seed dépôt in every tahsil. The Government hope that landowners will assist by establishing seed dépôts and have asked the Board of Revenue to set an example in the larger estates under the management of the Court of Wards.

8. Considerable criticism was directed by the members of the Legislative Council against some of the farms managed by the Agricultural department. The Government fully agree that a demonstration farm should easily pay its own way and that if it fails to do so the neighbouring cultivators cannot be expected to imitate its methods. Such farms will be closed, but the case of experimental and research farms is different, as their aim is to experiment with new varieties and new methods and experiments are bound to involve a certain number of failures. It is probable that where demonstration farms have failed to pay their way, the real reason is lack of supervision, due to the fact that the Deputy Directors have unwieldy circles, but the fact remains that it is not worth while to keep demonstration farms which fail to fulfil their purpose. The department is gradually strengthening the staff available for demonstrating on the cultivator's own land new methods and superior varieties evolved at the experimental farms. In this they are being helped by many landlords who have established demonstration farms on their own land. Practically all

these farms, besides assisting the department, are bringing in a considerable income to their owners.

9. One of the most important branches of the department is that of agricultural engineering. The progress made with the construction of tube-wells during the year under report was most disappointing, mainly owing to the fact that engineering material has risen enormously in price and is very difficult to obtain. The success of tube-wells in this province has been established and the demand for such wells is at present altogether beyond the powers of the Agricultural department. A large grant for equipment and for the building of a workshop was passed by the Council in the current budget, and the Government hope that before long the Agricultural Engineer will be in a better position to satisfy this demand. Apart from tube-wells, there are many other methods in which the engineer can assist the cultivator and relieve his cattle. The Indian Sugar Committee in their report have laid great stress on the importance of developing the Agricultural Engineer's branch, and have pointed out that if the cattle are relieved from tasks such as cane-crushing which they perform with small efficiency and with much loss of stamina they will have greater strength and energy for deep ploughing.

10. Mr. Parr, Deputy Director of the Western Circle, has carried out a most interesting series of experiments on the use of baisurai (*Pluchea Lanceolata*), a well-known weed which covers over a million acres in this province. He has found by experiments at the Agra and Aligarh farms that this weed can replace half the total fodder required by working bullocks, and that a ration of one-half green baisurai and one-half juar stalks gives better results than a full ration of juar stalks. The Director points out that if full use were made of this discovery in the districts of Aligarh, Muttra, Etah and Agra where the weed is most prevalent, some six million maunds of other fodder could annually be saved. The Government hope that the Council will vote a grant to enable this use of baisurai to be widely demonstrated and tested, so that the cultivator may become familiar with it and be willing to use this substitute freely when the next fodder famine occurs.

11. The Governor, acting with his Ministers, desires to thank the Officiating Director, Mr. Clarke, for a most interesting report and to thank both the permanent Director, Mr. Leake and Mr. Clarke, for the zeal and efficiency with which they have carried out their duties. He also desires the Director to convey to the Deputy Directors and the other members of the department his appreciation of the valuable work which they are doing on behalf of agriculture.

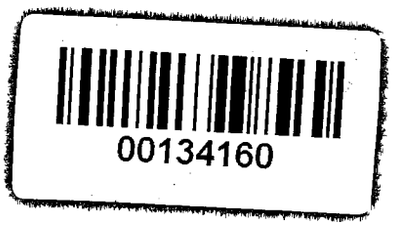
ORDER.—Ordered that a copy of this resolution be forwarded to the Director of Agriculture, United Provinces, for information.

Ordered also that this resolution be published in the *United Provinces Government Gazette.*

By order,

H. S. CROSTHWAITE,

Secretary to Government, United Provinces.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